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Geology

RMO-441

Supplemental and Summary Report
on Western Carrizo Uplift and Chuska
Mountains Areas of Northern Navajo
Indian Reservation, Northeastern Arizona

April 1946

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Grand Junction, Colo.

Mr. Robert R. Ridgway
18th Floor - 50 E. 42nd St.
New York City 17

April 19, 1946

Letter of Submittal
Supplemental and Summary
Rept. on Western Carrizo
Uplift and Chuska Mountains
Areas of Northern Navajo
Indian Reservation, Ariz.

Dear Mr. Ridgway:

Attached is our supplemental and summary report with corollary maps on the Western Carrizo Uplift and Chuska Mountains Areas of Northern Navajo Indian Reservation, Northeastern Arizona. Approximately 400,000 tons of ore, mainly inferred, are estimated in these areas.

You will note that this report covers parts of two areas, in contrast to our usual district report.

Considerable work has been done on the Navajo Indian Reservation at various times by different personnel and for divergent purposes. Our first effort in this region was at the time the Curran Bros. and Wade prospecting lease was acquired by the U. S. Vanadium Corp. and subsequently by the Union Mines Development Corp. This lease was essentially a prospecting permit covering approximately 168 sq. mi. of very rough terrain. As lessee, we had a limited time to select an area of restricted size for a formal lease. A none too generous time limit was set by the U. S. Indian Service and we were required to find all the outcrops of mineralization and tie them to some landmark by what surveying was necessary so that final selections of formally leased tracts could be made. Speed, therefore, was a prime prerequisite and geologic and engineering technique were subordinated to the time element.

Having located and tied all the mineralization, it was then necessary to survey the tracts selected for formal lease and to tie the survey to points referred to the U. S. General Land Office grid system. Triangulation control and latitude and longitude calculations were made to effect the tie and boundary surveys in order to delineate the lease plots. This work was done under the adverse conditions of severe winter weather and against a time deadline. Little geologic information could be added during this period of surveying. Also, during this early period, a change in assay laboratories was made from Burlingame to Tonawanda and the assay results were of two orders of accuracy.

Mr. Ridgway

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It appeared necessary to make a general report on these areas to summarize and supplement information that was more or less inadequate due to time pressure on our early work. We were most unfortunate in losing E. H. Bakland, Jr. to the draft before the final survey was made as Bakland was in charge of most of the previous work in this region.

It should be noted that all the major objectives were satisfactorily completed within the required time limitations. Approximately 168 sq. mi. was prospected and the most attractive mineralization located with reference to Brunton compass maps. A selection of the best tracts was made. The tracts were delineated by proper survey and tied to the GLO grid system by a long triangulation net. In addition to the above, considerable geologic data were collected.

The Durian (Sch Atin) District was mapped under no time pressure by our usual methods and thus corresponds to the standards of our usual district report. It represents a part of the same region and should be considered in conjunction with the attached report.

Respectfully submitted,

Benj. N. Webber
Benj. N. Webber

BHW/dab

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REPORT RMO - 441

April, 1946

Supplemental and Summary Report on
WESTERN CARRIZO UPLIFT AND CHUSKA MOUNTAINS AREAS OF
NORTHERN NAVAJO INDIAN RESERVATION
NORTHEASTERN ARIZONA

by

John Harshbarger

UNION MINES DEVELOPMENT CORPORATION
Grand Junction Field Office
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Western Carrizo Uplift and Chuska Mountains Areas of
Northern Navajo Indian Reservation

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Supplemental and Summary Report
Western Carrizo Uplift and Chuska Mountains
Areas of Northern Navajo Indian Reservation

INTRODUCTION

Location and Accessibility

The western part of the Carrizo Uplift Area and the Chuska Mountains Area lie in the Northern Navajo Indian Reservation, Apache County, northeastern Arizona (see Index Map, Fig. 1A). These areas are on the unsurveyed land on the west flank of the Carrizo Mountains, stretching southward from the Utah-Arizona State boundary to the north slope of the Chuska Mountains. The western Carrizo Uplift Area, as defined in this report, includes the Eurida (Toh Atin), Sigi Ho Cho, Toh Acon, and Kinusta Districts. The Chuska Mountains area contains the Cove District.

The few white inhabitants of the general region are found at the Mexican Water, Red Mesa, Sweetwater, Red Rock, Teec Nos Pas, and Beclabito trading posts and at the Emmanuel Mission. The nearest settlement of any size is the town of Farmington, New Mexico, which is about 85 miles to the east. This town is the usual staging point for expeditions into the Navajo Reservation. Supplies may be purchased at the trading posts but as the selection is limited, most of the supplies needed in the field work within the reservation are brought from Farmington.

From Farmington the route to the Reservation areas follows U. S. Highway 550 westward to Shiprock, New Mexico and then continues westward on a fair dirt road along the eastern and northern flanks of the Carrizo Mountains, passing the trading posts of Beclabito and Teec Nos Pas and on to the Mexican Water trading post. From this road, branch roads turn north to the Red Mesa trading post or south to the Sweetwater trading post and Emmanuel Mission. These and other side roads and wagon trails that are passable by truck are shown on the Index Map, Figure 1A, and on the areal geologic maps accompanying this report. In addition, there are many interconnecting Indian wagon trails which can be negotiated by truck. Thus the major portion of the district is readily accessible in favorable weather although most of the roads and trails are hazardous in the winter and in the summer rainy season.

Field Methods

As no suitable base maps were available, the early field work, September to December, in 1943, was mainly of a reconnaissance

nature. The exposed mineralization occurrences were located and examined and field descriptions of them were written. Cove District and a part of Kinusta District were mapped by plane table. Sigi Ho Cho, Altar, Friday, Sunnyside, and Eurida Mesas were prospected and their mineralization occurrences sketched by Party No. 2. The remaining portion of the Kinusta District, a part of the Toh Acon District, and the Saytah Canyon and Wash (now North Carrizo), and the Martin Mesa localities were mapped by Brunton compass and pace methods by Party No. 3. Samples of the mineralization occurrences were taken by all parties.

In December, 1943 and January, 1944, Union Mines Development Corp. leases were laid out, and in this connection a primary triangulation network was established by Party No. 4 and the selected leased plots tied to it by Party No. 3, Thomas W. Holmes of the U. S. Vanadium Corp. assisting. The final location of these plots is shown on the maps accompanying this report.

From February to May, 1944, Party No. 3 completed the mapping of the Toh Acon, Eurida (Toh Atin), and the northern portion of the Sigi Ho Cho Districts. A secondary triangulation system was made by telescopic alidade and plane table but the actual mapping was done by Brunton compass and pace methods. Columnar sections and profiles were measured by tape and Brunton compass level.

Party No. 3 returned to the area in July, 1945 in order to complete the data needed for the calculation of the ore reserves. Many of the mineralization occurrences in the Sigi Ho Cho, Toh Acon, Kinusta and Cove Districts were re-examined and the previously made sketches and descriptions checked, corrected, or amended. Several new discoveries as well as some not examined in the original field work were examined, mapped, and described. Kinusta Mesa, Sigi Ho Cho Mesa, and the Rattlesnake Lease group were surveyed by telescopic alidade and plane table in order to delimit the possible inferred ore blocks.

The personnel of the various field parties which examined the areas covered by this report are given below.

Party No. 1

The late Alfred H. Coleman, Party Chief
Leonid Bryner
Richard B. Walls
Paul O. Elmquist
Abbott Charles (for a short period)

Party No. 2

Francis X. Corbett, Party Chief
Robert G. Wedemeier
Sam K. Smyth
George P. Zebal

Party No. 3

Robert I. Chapman, Party Chief (for a short period)
Rodney B. Hoover (for a short period)
Edward H. Eakland, Jr., Party Chief
Henry R. Wardwell
Sam K. Smyth (Acting Party Chief for short period)
John W. Harshbarger
Padraic Partridge
Stephen T. Novotny
Leonid Bryner

Party No. 4

Anthony M. Mastrovich, Party Chief
Bartow W. Van Voorhis, Jr.

General Purpose of Survey

During the period 1943 and 1944, the primary purpose was to locate, describe, sample, and generally evaluate the SOM-vanadium mineralization in the western Carrizo Uplift and Chuska Mountains Areas. To this end, the areal geology of the areas, with emphasis on the Salt Wash member of the Morrison formation, was mapped. The triangulation and the laying out of leased plots were supplemental parts of this work.

The field work in 1945 was for the purpose of collecting additional and supplemental geological data in order to complete the record and to calculate the ore reserves of the areas.

Acknowledgments

Grateful acknowledgment is given to the proprietors of the trading posts in the areas, especially A. E. Palmer and Troy Washburn of the Sweetwater trading post, who supplied living quarters for party members and valuable information concerning the roads and available water supplies. Several field cooks, especially Regden S. Whitson, accompanied the parties at various times.

Mr. J. E. Weston and Mr. Thomas W. Holmes of the U. S. Vanadium Corp. gave invaluable assistance in the selection and surveying of the leased holdings.

Reclassification of Areas, Districts, and Localities

Due to the unsurveyed nature of the areas, many variations in the designation of the areas, districts, and localities and in their grouping have arisen during the examination and in the reporting of the mineralized occurrences in the Northern Navajo Indian Reservation.

The first reconnaissance work was carried on in the southern districts on the Wade-Curran Prospecting Lease. The Monthly Progress Report for August, 1943 called this region the Alcove District of the Chuska Mountains Area. In the September Progress Report the same area was divided into the Alcove District (Cove Mesa) and the Hogansaani District (Kinusta Mesa). In the October Report, the Chuska Mountains Area was limited to the Cove District (Cove Mesa), and the area to the north which formed a physiographic unit around the Carrizo Mountains was designated as the Carrizo Uplift Area. The Kinusta and Sigi Ho Cho Districts were included in the latter area and the Alcove and Hogansaani District terminology was dropped. In the November Report the Eurida District (Emmanuel Mission Mesa), and in the December Report the Beclabito and Toh Acon Districts were added to the Carrizo Uplift Area. In March, 1944 the Eurida District was changed to the Eurida (Toh Atin) District with the reassignment of some of the more easterly localities to the Sigi Ho Cho District.

Preliminary Reconnaissance Reports covering the period from October to December, 1943 were submitted in January, 1944. These are listed below:

1. Kinusta, Toh Acon, and Eurida Districts
By E. H. Eakland, Jr. et al.
2. Kinusta Mesa (Showings 1 to 14)
By E. H. Eakland, Jr.
3. Sigi Ho Cho, Altar, Friday, and Eurida Mesas
By F. X. Corbett
4. Cove Mesa and Two Small Mesas (South of Cove Mesa)
By A. H. Coleman
5. Mexican Cry Mesa
By A. H. Coleman

The maps, sketches, and profiles submitted at the same time included those listed below:

Ariz-cu-cm-5	Districts Covered by Wade-Curran Lease, Carrizo and Chuska Areas
Ariz-cm-2	Cove Mesa District - Chuska Mtn. Area Sketches of Sections and Ore Showings Nos. 1,3,4,11,12,13,15, and 17
Ariz-cm-3	Cove Mesa District - Chuska Mtn. Area Sketches of Sections and Ore Showings Nos. 18,20,24,25,28,32,38,42,44,48 and S48
Folder	Navajo Reservation-Arizona-Carrizo Uplift Area; Kinusta, Eurida, and Sigi Ho Cho Districts, Corbett and Eakland Maps. Small topographic maps, claim maps, profile and detail sketches Nos. 1-88.

From January through September, 1944, several letters concerning sample numbers, assays, and Union Mines Development Corp. leased plots as well as several copies of the areal map, Ariz-cu-cm-5, showing sample and assay data and the sketched delineation in green of the selected Union Mines Development Corp. plots were submitted. In September, 1944, a tabulation of all the sample and assay data referable to the areas covered in this report with a covering letter concerning them was sent to the New York Office. All the data previously submitted has been revised or summarized in the present report. The following formal reports have been or are being submitted on districts in the Carrizo Uplift Area:

B'Cla B'Toh District, Carrizo Uplift Area, Arizona-New Mexico

By A. H. Coleman

Eurida (Toh Atin) District, Carrizo Uplift Area, Arizona

By E. H. Eakland, Jr.

In order to clarify this confusing and varying terminology, the following revised classification, giving areas, districts, and localities and the areal sheets showing them, has been submitted for this and any subsequent reports on the areas involved.

1a. Carrizo Uplift Area (Eastern Section), Arizona-New Mexico

A. B'Cla B'Toh District

Also called Beclabito, Bitlabito, and Biltlabito.

Located on the eastern slope of Carrizo Mountains along the Arizona-New Mexico state boundary. Formal report submitted and included data are not summarized in this report.

1b. Carrizo Uplift Area (Western Section), Arizona

A. Eurida (Toh Atin) District

Also called Toh A Tin. On outlying western slope of the Carrizo Mountains, to north and west of main mineralized localities. Formal report being submitted in connection with this report and the pertinent data are summarized in this report.

- a. Sweetwater Mesa Locality (Ariz-cu-16)
- b. Red Mesa Locality (Ariz-cu-17)
- c. Mexican Water Locality (Ariz-cu-18)

B. Sigi Ho Cho District

Also called Siggy Ho Cho. On western slope of Carrizo Mountains. Covers most of the mineralized Salt Wash exposures. 10 of 12 Union Mines Development Corp. leased plots lie in this district. (Navajo Indian Reservation Lease)

- a. Martin Mesa Locality (Ariz-cu-24)
Formerly included in Old Eurida District
- b. North Carrizo Locality (Ariz-cu-24)
Formerly included in old Eurida District
- c. North Saytah Canyon (Ariz-cu-24)
Formerly included in old Eurida District
- d. South Saytah Canyon (Ariz-cu-24)
Formerly included in old Eurida District
- e. Carrizo Mountains Locality (Ariz-cu-24)
- f. Eurida Mesa Locality (Ariz-cu-23, -24)
Formerly included in old Eurida District
- g. Emmanuel Mission Mesa Locality (Ariz-cu-23)
Formerly included in old Eurida District
- h. Altar Mesa Locality (Ariz-cu-23)
- i. Friday Mesa Locality (Ariz-cu-23)
- j. Sunnyside Mesa Locality (Ariz-cu-23)
- k. Sigi Ho Cho Mesa Locality (Ariz-cu-23)

C. Toh Acon District

Also called Toh A Con. On western slope of Carrizo Mountains, covering small showings along the western edge of the main mineralization.

- a. Toh Acon Mesa Locality (Ariz-cu-15)

D. Kinusta District

Also called Kenusta. On southwestern slope of Carrizo Mountains, covering important area of mineralization and one of large plots of

the Navajo Indian Reservation Lease of
Union Mines Development Corp.

- a. Kinusta Mesa Locality (Ariz-cu-23)

2. Chuska Mountains Area

A. Cove District

At northern end of the Chuska Mountains, covering
important mineralization.

- a. Cove Mesa Locality (Ariz-cm-1)
Southern two-thirds of mesa covered by Navajo
Indian Reservation Lease of Union Mines
Development Corp.
b. East Mesa Locality (Ariz-cm-1)
c. West Mesa Locality (Ariz-cm-1)

B. Mexican Cry Mesa District

South of Cove District and not included in this
report. For location see old map (Ariz-
cu-cm-5).

The present supplemental and summary report concerns itself primarily with the mineral resources of the Sigi Ho Cho, Toh Acon, and Kinusta Districts of the western Carrizo Uplift Area and the Cove District of the Chuska Mountains Area. However, information on the areal geography and geology, necessarily neglected in the preliminary reports, is included. The old maps, Ariz-cm-2, -3 and Ariz-cu-cm-5, have been superseded by newer maps. The first two may be referred to for the details concerning certain ore occurrences but the SOQ assay results posted on them have been replaced by newer assay data. Similarly, the descriptions and sketches in the preliminary reports may have been replaced by more recent and revised assay and field data. The older and the newer information has been correlated into this report and there should be little need to refer to the preliminary reports or earlier maps. It is believed that all the inadequacies in the preliminary reports, letters, and maps submitted have been corrected in the present report which gives the final and correct picture of the areas involved.

GEOGRAPHY

Physiography

The western Carrizo and Chuska Mountains Areas lie within the Gothic Mesas physiographic sub-division of the Navajo Section, Colorado Plateau Province as defined by Gregory¹. A

¹Gregory, H. E., U. S. Geol. Survey Prof. Paper 93

nearly flat, post-Cretaceous uplifted plateau has been maturely eroded by stream and arid climate agencies to produce scattered mesas, retreating escarpments, and broad and shallow canyons and dry washes. Most of the Cretaceous and a large part of the upper Jurassic formations have been removed so that the remnants of these sedimentary beds, exposed in the topographic forms enumerated above, rest on the lower Jurassic Navajo sandstone. In more recent times, rejuvenated streams have cut a few narrow incised canyons in the Navajo basement rock and in the Quaternary unconsolidated alluvium and gravels which cover the basal formation. Thus two cycles of erosion are clearly apparent.

As is common in such arid regions, the steep walls of the mesas and escarpments are relatively free from talus but the tops of the mesas, the foot of the cliffs, and the wide valley plains are usually covered with sand dunes and water-borne sediments.

The Carrizo Mountains are reported to be an uplifted truncated laccolith, and the Chuska Mountains to the south are formed by a narrow, flat-topped, steep-walled mesa remnant of Eocene sediments resting on a truncated monocline.

Locally the physiographic expression is due to the degree of competency of the sandstone and shale formations. The more resistant sandstones form cappings and steep cliffs while the shales form steep slopes between the sandstone rims.

Topography

The topographic forms in the areas discussed are typical of arid regions. They have been enumerated above. The relief of the areas ranges from 5000 to 7000 ft. above sea level, generally sloping westward from the Carrizo Mountains which rise to 9000 ft. in places. The mesas stand from 400 to 500 ft. above the Navajo sandstone plain and some of the steep-walled canyons incised in the plain may reach a 200-ft. depth. The mesa tops are flat, gently dipping or rounded with the relief on them usually less than 100 ft. The Navajo sandstone plains are gently rolling surfaces. To the west, the relief decreases and has a minor topographic expression except for Toh Atin Mesa which stands 800 to 1000 ft. above the plain.

Water Resources

Water is relatively scarce in all the districts. Walker and Toh Jin Lin Creeks carry water most of the year with 5 to 40 second feet depending on the season. This water is used locally for the irrigation of the small cultivated plots of

the Indians but it is not fit for human consumption due to stock pollution and contained mineral salts.

There are a few widely scattered springs which are used for domestic and stock purposes. The best of these is located at the Sweetwater trading post. Their average flow is about 2 to 3 gallons per minute. The water for the field parties was usually hauled from the Sweetwater spring.

Some deep and shallow wells have been drilled by the U. S. Indian Service for the benefit of the local Indians. Windmills have been placed on some of these and the water is stored in open tanks. The water source of these wells is probably in the Navajo sandstone.

Vegetation

Vegetation is scarce and the types are of the arid and semi-arid varieties. Bunch grass, isolated junipers, yucca (soap weed), and prickly-pear cactus can be found on the plains. On the mesas, where there is some residual soil, a few junipers, scattered pinons, and abundant bunch grass grow. Mormon (Brigham) tea and sage brush are also present. The Carrizo and Chuska Mountains are well forested with pines, and the creek bottoms often show salt cedar bushes and occasional willows.

Climate

The climate is arid with hot summers and cold winters. The temperature ranges from below 0° F. to above 100° F. The summer heat is alleviated by the low humidity and cool nights. The average rainfall is 5 to 10 in. per year and is concentrated in a few summer thunder showers and about 10 light snows in the winter. The alternate freezing and thawing plus the snow in the winter and the short rainy season in the summer make the roads hazardous for travel. Except for the months of August and September, strong south winds, with abundant dust and sand, blow almost constantly.

GEOLOGIC RELATIONS

Areal Distribution of Cartographic Units

The three large areal geology maps, Ariz-cu-16, -17, and -18, and the three similar maps, Ariz-cu-15, -23 and -24 show the

distribution of the formations as mapped in the areas covered by this report. Particular attention was given to the Salt Wash member of the Morrison formation, and the adjacent formations were only mapped where it was necessary or convenient.

The oldest formation exposed in the areas is the Jurassic Navajo sandstone which forms the basement plain. This formation is far more extensive than is shown on the maps but it is usually covered by alluvium and sand and its distribution has no bearing on the purpose of the examination.

The Jurassic San Rafael group of sediments lies on the Navajo but it has not been completely differentiated into its component parts due to its obscure contacts, its gradational character and its often inaccessible exposures on the cliffs. The sediments of this group occur in the lower portions of the mesa cliffs and are quickly eroded away when not capped by more resistant beds. In the southern districts, the whole group is usually exposed below the mesa rims but in the northern districts, the exposures are intermittent and usually only the upper section of the group can be seen.

The Jurassic Morrison formation, the next higher stratigraphic unit, caps most of the mesas. The basal member in most of the Toh Acon Mesa and Martin Mesa Localities and in the Eurida (Toh Atin) District is the Bluff sandstone which occurs as vertical cliffs. Except in the very northern and western parts of the Carrizo Uplift Area, it is thin, intermittent, and obscure. It is not shown on the areal maps but does appear in the profiles and sections where present.

Where the Bluff does not occur, the Salt Wash member, a resistant sandstone, is the basal member of the Morrison. It occurs as the cap rock on most mesas throughout the areas but much of its possible exposure is covered by wind-borne or residual mantle.

The upper Morrison members are only present on the higher and better protected mesas or on the high slopes of the mountains. The Recapture shale has only been identified in poor exposures and erosional hills in the Mexican Water Locality and at the base of Toh Atin Mesa. The Westwater and Brushy Basin sandstones and shales are poorly exposed around the sides of Toh Atin Mesa which also has a small remnant capping of Cretaceous Dakota formation. Undifferentiated upper Morrison was also recognized in the northeastern part of the Sigi Ho Cho District.

Igneous rock intrusives are exposed in the north and central parts of the Sigi Ho Cho District. These occurrences were not mapped in the field but their exposure outlines were taken from

a map reported to have been copied from a U. S. Geol. Survey map by Jensen. No further reference has been found but the delimited igneous exposures are judged to be sufficiently accurate for the purposes of this report. The only other igneous occurrences shown are a plug and a few dikes in the Mexican Water Locality.

Stratigraphy

GLEN CANYON GROUP - JURASSIC

The only formation of this group which is exposed in the areas examined is the Navajo sandstone. This formation forms the basement rock of the district but is only exposed in the deeper canyons between the mesas. It was not mapped or described in detail in any of the districts. This sandstone forms steep, rounded canyon walls with broad, rounded shoulders, marked by weathered dome-shaped buttes and alcoves. The upper contact is a beveled surface. The massive, light-tan exposures have extensive, long, sweeping, tangential cross-bedding accentuated by erosion.

This formation is best observed in the canyons adjacent to Cove Mesa, in the canyons south of Kinusta Mesa, in Walker Creek to the north of Kinusta Mesa, in the canyons bordering Toh Acon Mesa, and around the base of the mesas in the southern portion of Sigi Ho Cho District. It is seldom exposed in the northern portion of Sigi Ho Cho or in the Eurida (Toh Atin) Districts.

SAN RAFAEL GROUP - JURASSIC

This group of sedimentary formations occurs throughout the areas, resting on the beveled and unconformable surface of the Navajo sandstone and underlying the Jurassic Morrison formation. The group was often partially covered by alluvium and was incompletely differentiated due to the similarity of the lithology of the units, their gradational contacts, their poor exposures, their inaccessibility and the lack of correlation with known occurrences in other districts. In the Cove, Kinusta, and Toh Acon Districts, the group is separated into a lower (Carmel equivalent or mostly pre-Entrada) unit and an upper (Entrada and Summerville formation or mostly Entrada) unit. Even this division could not be made in the Sigi Ho Cho and Eurida (Toh Atin) Districts.

The San Rafael group is composed of a series of predominantly thick and flat-bedded, fine- to coarse-grained, reddish brown silty and limy sandstones and sandy siltstones and mudstones. Locally there is weak cross-bedding. Numerous thin interbedded

clay and sandy shale partings with calcareous concretions are seen. The bedding, particularly in the more northern districts, is wavy and crenulated due to the slumping and compaction during consolidation. Bleaching of the beds is locally prominent.

The exposures are vertical and rounded cliffs, irregular benches and step-like slopes. The surface is knobby and "stone babies" are common due to spheroidal weathering along the partings and joints.

Cove District (Ariz-cm-1)

The San Rafael has been partially differentiated in this district but no columnar sections were measured of the formations. Descriptions of the various facies were recorded in the field.

Lower (Carmel Equivalent): This facies is a reddish-brown to orange-red sandy siltstone, resting unconformably as an irregular bench on the beveled Navajo formation.

Upper (Entrada and Summerville formations): The conformably overlying silty reddish-brown Entrada formation forms nearly vertical cliffs of crinkled, sandy mudstones and silty sandstones, capped by an even, rounded resistant cliff of massive, medium-grained, buff sandstone and grayish-brown, cross-bedded, coarse-grained, calcareous sandstone of the Summerville facies.

Kinusta District (Ariz-cu-23)

In this district, the San Rafael was partially differentiated in the same manner as in the Cove District. Incomplete sections are shown in Columnar Sections and Profiles Nos. 1 and 2.

Lower (Carmel Equivalent): The Carmel formation is poorly exposed on a talus-covered, irregular bench at the base of the cliffs. It rests on the beveled Navajo formation surface and is similar in lithology and structure to that in the Cove District.

Upper (Entrada and Summerville Formations): Conformably overlying the Carmel facies with gradational contact, the thick and flat-bedded, reddish-brown, silty sandstones with thin bands of cream-colored clay and reddish-brown mudstones of the Entrada facies are exposed on a knobby, sheer cliff surface. Rows of "stone babies" and the selective bleaching of the beds are common features. The average thickness is about 58 ft. The Summerville facies, conformably overlying the Entrada with gradational contact, shows as a steep slope with vertical ledges and reefs. It consists of reddish-brown, orange-brown, and dark-brown, predominantly thick- and flat-bedded to steeply cross-bedded, fine- to medium-grained arkosic and silty sandstones

with coarser grains along the cross-bedding planes and with some hard, thin, limy, resistant beds. Calcareous concretions and bleaching of beds are common. The average thickness is about 72 ft.

Toh Acon District (Ariz-cu-15)

In this district, the San Rafael group has been partially differentiated in a similar manner to that in the Cove and Kinusta Districts. One complete 360-ft. section, in the north-western corner of the district near Survey Station No. 36, has been recorded in the field but is not shown on the maps. Nine incomplete columnar sections were measured along the cliffs of Toh Acon Mesa and are shown in this report.

Lower (Mostly pre-Entrada): The Carmel facies consists of flat-bedded, reddish-brown, and orange-brown shales and mudstones with platy and laminated partings of buff sandstone and a few light-green mudstones. The exposures are gently to moderately steep, irregular, shaly slopes with thin ledges of more resistant calcareous sandstone. The bottom contact is an unconformity with the beveled Navajo formation. The upper contact is gradational and indistinct. In the north-western part of the district where a complete section is exposed, the thickness is about 144 ft.

Upper (Mostly Entrada): The Entrada facies in the north-western part of the district consists of a lower cliff of flat-bedded, massive, reddish-buff, silty sandstone with bleached streaks and spots and an upper steep, rounded slope of pronounced wavy and contorted reddish-buff silty sandstone and reddish and purplish brown and light-green mudstones, with blood-red streaks parallel to the bedding. The crenulations decrease upward. In this locality, onion-skin structure is very prominent and is due to the spheroidal weathering of the joint blocks. To the southeast, the Entrada facies shows as a knobby cliff with local crenulations due to slumping. The beds are flat and thick-bedded, predominantly reddish-brown but subordinately brick-red, siltstones and silty sandstones with some grayish-white or light-green bleached bands. Inter-bedded, there are dark-red siltstones, brown and light-green clayey shales and a few light-green calcareous sandstones. The surface of the cliff exposures are often mottled reddish-brown and greyish-white. The average thickness of the Entrada facies is 76 ft. with a maximum thickness of 140 ft. to the northwest and a minimum thickness of 53 ft. to the southeast.

The Summerville facies in the northwestern part of the district consists of alternating cliffs and ledges with steeply curved shoulders under the conformable Bluff sandstone of the

Morrison formation. Rounded "stone babies" are prominent and in general the facies is more silty in this locality than in the Cove and Kinusta Districts. The lower third of the facies is a reddish-buff, silty sandstone similar to the Entrada while the upper two-thirds is a thick- and flat-bedded, buff to white, sandy siltstone with a few interbedded thin, reddish-brown, calcareous sandstones and light-green siltstones. The maximum thickness of this facies in this locality is 76 ft.

To the southeast, the Summerville is expressed by a rounded steep slope or cliff or more massive, flat-bedded, predominantly reddish-brown but subordinately light-brown sandstone with scattered calcareous concretions, some thin, interbedded, dark-brown to grayish-white limy sandstones and friable, maroon sandstones and siltstones. The uppermost units are gently to steeply cross-bedded and throughout its section there are light-green bleached spots. The average thickness for the district is about 40 ft. with a minimum thickness in the center of 7 ft. and with a thickness of 71 ft. to the southeast.

Sigi Ho Cho District - Southern Part (Ariz-cu-23)

The San Rafael group was undifferentiated in the mapping of this part of the district and no complete column has been measured or described. The best exposures occur around Emmanuel Mission Mesa but the base of the group is not exposed. The upper part of the Carmel facies is a massive, fine-grained, reddish-brown sandstone with fine, bleached-white bands of friable, fine-grained sandstone. It has a maximum exposed thickness of 42 ft. The Entrada facies is a vertical cliff of thick-bedded to massive, light reddish or chocolate-brown, fine-grained sandstone with thin bands of bleached-white, friable sandstone. Iron-coated rounded grains are loosely and firmly cemented with lime. Dark-brown sandy shale partings are interbedded in the sandstones. Crenulated bedding planes, local rows of "stone babies" and large elliptical calcareous concretions in rows parallel to the bedding are common occurrences. The thickness varies from 129 to 149 ft. The Summerville facies is exposed as a smooth cliff or rounded ledge with conformable upper contacts with the Bluff or Salt Wash members of the Morrison formation. It consists of reddish or light-brown and buff, predominantly limy, massive, locally cross-bedded, fine- to medium-grained, often bleached, banded sandstone. The thickness varies from 10 to 19 ft.

Sigi Ho Cho District - Northern Part (Ariz-cu-24)

The incompletely exposed series of silty sandstones of the San Rafael group were not differentiated in this locality. The beds consist of reddish-brown to orange-red, flat-bedded,

moderately calcareous, friable sandstones with intercalated 6-in., hard, calcareous siltstones and silty sandstones. It is exposed as a steep to vertical cliff of alternating resistant and soft silty ledges which weather into nodular and knobby outcrops with abundant "stone babies". The warping and crenulation of the beds is prominent in the upper half of the sections. The maximum incomplete thickness is about 109 ft.

Eurida (Toh Atin) District (Ariz-cu-16, -17, -18)

The undifferentiated San Rafael group, as described by Eakland in his formal report on this district, shows as steep to vertical cliffs of reddish to orange-brown silty sandstones and mudstones which are flat-bedded, somewhat calcareous, friable, and very fine-grained. Hard and calcareous siltstones are intercalated. Bleaching and crenulation of the beds are prominent. The average thickness of the group in this district is about 205 ft.

MORRISON FORMATION - JURASSIC

The Morrison formation is seldom completely exposed in the areas covered by this report. The basal members, either Bluff or Salt Wash sandstone, are exposed near the top of the mesas and the latter sandstone usually caps the mesas. The upper Morrison formation is only exposed in the Saytah Canyon-North Carrizo Localities and in the Eurida (Toh Atin) District. The complete thickness of the Morrison is estimated at 900 to 1000 ft. The formation is of major importance for all the known SOM-vanadium occurrences of the areas lie in its Salt Wash member.

Bluff Member: This unit occurs as intermittent, generally thin, gently cross-bedded to flat-bedded, friable, white to gray, fine- to medium-grained sandstone lenses composed of sub-rounded to sub-angular quartz and feldspar with minor chert and, locally, weak lime cement. Coarser grain particles occur along the cross-bedding planes. It has apparent conformable contacts except in the northern districts where it lies on the contorted San Rafael beds. This sandstone forms rounded shoulders above the upper San Rafael beds and where thickest appears as a rounded undercut cliff. The Bluff member thickens northward from its most southerly exposures in the Toh Acon Mesa and in the central part of the Sigi Ho Cho District.

Salt Wash Member: This is the basal unit of the Morrison formation where no Bluff sandstone is present. Where Bluff is present, the Salt Wash sandstone rests conformably on the Bluff sandstone. The contact with the San Rafael group is apparently conformable in the southern districts but unconformable to the north where the San Rafael beds have been contorted.

The Salt Wash member caps most of the mesas with a series of alternating step-like, steep slopes or benches and nearly vertical cliffs. It consists mostly of gray, buff, yellow, brown, red and white, flat to steeply cross-bedded, thin- to thick-bedded, platy to massive, friable, fine- to medium-grained sandstone lenses of sub-rounded to sub-angular quartz. Thin gray, green, brown, and lavender mudstones and clayey shales and black carbonaceous seams are interbedded in the sandstones. The base is often a thin clacareous or gritty sandstone or a sandy limestone. The sandstones are weakly to strongly cemented with lime and show specks and staining of iron. Light-green to maroon to brown clay galls are often present in the shaly sandstone partings and scattered calcareous concretions, ripple marking and sand-filled mudcracks are locally found. The breaks in sedimentation, i.e., diastems, contain carbonaceous material such as trash piles and petrified wood. Silicified logs and trees are relatively scarce in comparison to other districts in Colorado and Utah. The complete thickness of the Salt Wash is seldom exposed and is probably variable throughout the areas. In general the member thins out to the north.

Upper Morrison Members: The upper members of the Morrison formation are exposed only in the northeastern part of the Sigi Ho Cho District and in the Eurida (Toh Atin) District. Complete exposures are seldom found even in these districts and the members have not been studied in detail. The Recapture, West-water, and Brushy Basin facies have been recognized and are briefly described under the districts in which they occur.

Cove District (Ariz-cm-1)

The Salt Wash sandstone is the basal and only member of the Morrison exposed in this district. It lies with apparent conformity on the San Rafael group as a thick capping. The upper part of the member and the upper Morrison members have been eroded away. Columnar Sections A through F on the areal map show the incomplete section measured on Cove Mesa.

The thick sandstone capping appears as a steeply sloping series of step-like benches with short sloping treads. The sandstone lenses are gray, buff, yellow, brown, and red, flat- to steeply cross-bedded, thin- and thick-bedded, platy to massive, and friable with rounded to sub-angular, fine- to medium-grained, quartz grains weakly to well-cemented with lime and speckled with iron staining. Light-green to maroon clay galls, averaging 0.1 ft. in diameter, occur in the sandstone partings. The lenses are separated by thin gray, green, brown, and lavender mudstones and black carbonaceous seams. Several thin calcareous sandstone or sandy limestone beds are found at the base. The maximum incomplete thickness measured was 113 ft. (Col. Sect. F).

The SOM-vanadium deposits occur from 10 to 93 ft. above the base of the Salt Wash member but the majority and best mineralized occurrences are limited to an upper horizon from 43 to 93 ft. above the base. The deposits are associated with diastems containing trash piles or with shaly sandstone partings in uniformly deposited calcareous sandstone.

Kinusta District (Ariz-cu-23)

As in the Cove District, the Salt Wash sandstone is the basal and only member of the Morrison formation present. It lies with apparent conformity on the San Rafael group, as a series of steep slopes separated by nearly vertical cliffs. The top of its exposure on Kinusta Mesa is covered by dunes of wind-blown sand. Columnar Sections and Profiles Nos. 1 and 2 show the incomplete section of this member.

Lenses of white, gray, buff, brown, and red, gently to steeply cross-bedded, thin- to thick-bedded, laminated to massive and mostly friable sandstone are interbedded with hard, calcareous sandstones. Light-green and brown clay galls, less than 1 in. in diameter, in a sandy matrix appear at the base of the sandstone beds and a few beds show well-developed ripple marks and calcareous concretions. The basal beds in places contain quartzitic grits. Coarser grains are found parallel to the cross-bedding planes. The partings and seams in the sandstone lenses are gray, light-green, chocolate-brown and red clayey shales and light-green and brown paper-thin shales.

The maximum incomplete section measured, 120 ft., was in Columnar Section No. 1. With minor exceptions, the SOM-vanadium deposits occur in the upper half of that section, from 40 to 95 ft. above the base with the majority and best mineralized showings from 70 to 95 ft. above the base of the Salt Wash member. The smaller mineralization occurrences are associated with shaly sandstone partings containing carbonaceous material. There are relatively few diastems. The better mineralized deposits are associated with organic material such as logs, trees, reeds, and trash in the better developed diastems. A few occur in carbonaceous partings in clean, well-sorted and relatively hard calcareous sandstones.

Toh Acon District (Ariz-cu-15)

In this district, either the Bluff or the Salt Wash sandstone may be the basal member of the Morrison formation. In either case, their lower contacts appear to be conformable.

Bluff Member: This member occurs as thin intermittent sandstone lenses forming the rounded top of the curved Summerville

facies shoulder. This sandstone is white, cross-bedded, and friable with predominantly medium-grained but with some fine- to coarse-grained quartz and feldspar. Some of the cross-beds are gently inclined and the coarser-grained particles are aligned along the cross-bedding planes. Little lime cement and few lime concretions are found in it.

Individual lenses of Bluff sandstone were found at the southeastern end of the Toh Acon Mesa as delineated by Columnar Sections Nos. 5, 6, and 7; at the northwestern end by Columnar Sections Nos. 1 and 3; and one in the outlying mesa near the northwestern corner of the district. The maximum thickness in the northwestern exposure is 12 ft. but the average thickness of the lenses is only 5 ft.

Salt Wash Member: This member of the Morrison formation occurs as either the basal unit of the Morrison or conformable on the lenses of Bluff sandstone. Its outcrop consists of a series of vertical cliffs and steep slopes.

The sandstone lenses are gently cross-bedded and thin-bedded, medium-grained, friable, and grayish and to a lesser degree flat-bedded or steeply cross-bedded, thick-bedded, laminated, fine-grained, calcareous, and with shades of brown, buff, and locally light-green. The grains are rounded to sub-rounded and light-green to brown clay galls occur near the base of the lenses. Scattered calcareous concretions, 1/8 to 3 in. in diameter, iron-stained coatings, sand-filled mud cracks, and ripple marks are locally observed. The clayey shale partings with maximum thickness of 3 ft. occur between the sandstone lenses and are colored shades of brown and red and less frequently green and gray. Nodular reworked mudstone and thin, fine-grained, gray limestone often form the basal beds.

The maximum incomplete thickness of Salt Wash sandstone, 175 ft., was measured in Columnar Section No. 2. The average incomplete thickness is about 85 ft. The SOM-vanadium deposits are present mainly in the lower half of the thickest section, 29 to 81 ft. above the base of the Salt Wash sandstone. More than one-half of the ore showings lie from 40 to 60 ft. above the base but the more extensive deposits are in the upper two-thirds, 41 to 81 ft. above the base. The showings are similar to those of Kinusta Mesa except that the majority of the ore pods still remaining in the Toh Acon District are stratigraphically lower than those on Kinusta Mesa, with the overlap amounting to about 11 ft. In the Toh Acon District, the mineralization is more intimately associated with carbonaceous material such as tree trunks and fragments and with clay galls than in the Kinusta District but the diastems are less well defined than in the latter district.

Sigi Ho Cho District - Southern Part (Ariz-cu-23)

Discontinuous lenses of Bluff sandstone are locally the basal member of the Morrison formation at Emmanuel Mission Mesa but elsewhere the Salt Wash sandstone is the basal unit. There is no apparent unconformity between the underlying San Rafael group and the Morrison formation. The top of the Salt Wash member and the upper Morrison members have been eroded.

Bluff Member: The Bluff member is a lensing, 0 to 6 ft., light-gray to white, fine- to medium-grained, cross-bedded sandstone locally cemented with lime. It occurs as an extension of the rounded ledge or cliff of the Summerville facies of the San Rafael group.

Salt Wash Member: This incomplete member caps all the mesas with a series of ledges and talus slopes. On Emmanuel Mission Mesa, it is a thin- to thick-bedded, laminated and massive, fine-grained, cross-bedded, friable, gray, green, buff, and brown sandstone interbedded with thin, light-gray, reddish-brown, dark-brown, and light-green shale and sandy shale seams. Specks and staining of iron, limy cement, carbonaceous partings and thin, fine-grained, dark-gray limestones are locally prominent. The maximum incomplete thickness of the Salt Wash member, 240 ft., was measured on this mesa but the average thickness is about 170 ft. There are no known SOM-vanadium occurrences on this mesa.

On the other mesas, the sandstone is predominantly thin-bedded, fine-grained, cross-bedded, friable, and buff or grayish white interbedded with thin red to green clay seams and partings. Some thick and massive bedding also is found. Many of the sandstone beds are stained yellow and brown or purple and by iron or vanadium efflorescence and there are a few red and green shales and gray shale seams.

On Eurida Mesa, the incomplete maximum exposed thickness of the Salt Wash member is 188 ft., the average about 159 ft., and the mineralization is from 17 to 50 ft. above the base of the Salt Wash member. On Altar Mesa, the maximum incomplete thickness is 150 ft. with the mineralization from 25 to 27 ft. above the base. On Sunnyside Mesa, the maximum incompletely exposed thickness is 177 ft., the average about 160 ft., and the mineralization at about 53 to 60 ft. above the base. On Friday Mesa, the maximum thickness exposed is 250 ft., and the mineralization about 33 to 50 ft. above the base. On Sigi Ho Cho Mesa, the maximum thickness of the incompletely exposed Salt Wash member is 205 ft. with an average of 169 ft. and the mineralized zone from 56 to 92 ft. above the base. Thus there are two principal stratigraphic ore zones. The lower zone,

on Eurida, Altar, and Friday Mesas at about 17 to 50 ft. above the base and the upper zone, on Sunnyside and Sigi Ho Cho Mesas, at about 53 ft. to 92 ft.

Sigi Ho Cho District - Northern Part (Ariz-cu-24)

The Bluff member is the usual basal unit of the Morrison formation and lies unconformably on the contorted Summerville facies of the San Rafael group. The Salt Wash member is conformably above the Bluff and the undifferentiated upper Morrison occurs above the Salt Wash in the northeastern part of the district. There is no apparent unconformity within the Morrison.

Bluff Member: On Martin Mesa, this basal member lies intermittently and nonconformably on the contorted San Rafael group as a steep, rounded, undercut cliff. The sandstone is white to gray with reddish stains, cross-bedded, flat-bedded, highly friable locally, medium-grained with sub-angular to sub-rounded quartz and minor chert and coarse to very coarse quartz grains common along the cross-bedding planes. There are very few small calcareous concretions and minor green to brown clay seams. Its first appearance in the district is on the west side of Lower Saytah Wash where it has a thickness of 15 ft. (see Columnar Section No. 12). At the west end of Martin Mesa, the thickness is 25 ft. (see Columnar Section No. 5).

Salt Wash Member: The Salt Wash lies conformably on the Bluff member in the Martin Mesa Locality but unconformably on the San Rafael group in the North Carrizo locality where the Bluff is absent. Its exposures are steep cliffs of alternating nearly vertical cliffs of sandstone and steep slopes of inter-bedded shale and sandstone. The lenticular sandstone is usually gently cross-bedded, less often flat-bedded, thin-bedded, medium-grained, gray to light brown and loosely cemented with lime. Few steeply cross-bedded, laminated or platy, fine-grained, hard, well-cemented, calcareous, yellowish and reddish-brown beds occur locally. The sandstones are usually well-sorted with rounded to sub-rounded grains, predominantly quartz. Light-green to yellow and brown clay galls are common in the sandstones. Calcareous concretions are rare. Green, black, brown, grayish-green, and reddish-brown intermittent shale beds, 1 to 3 in. thick, occur as partings and wavy contorted bands in the sandstones.

The maximum incomplete thickness, 209 ft., was measured in Columnar Section No. 4. The average thickness is about 92 ft. The SOM-vanadium occurrences are in the lower one-third of the Salt Wash member, from 1 to 50 ft. above the base of the

Salt Wash. About 90 percent of the occurrences in the Saytah Canyon and North Carrizo localities are 14 to 45 ft. above the base. In Martin Mesa, the ore horizons are from 1 to 29 ft. above the base.

Upper Morrison Members: Adjacent to the Tertiary intrusives and between the Saytah Canyon and North Carrizo Localities, the undifferentiated upper Morrison formations are present. There are few exposures and no definite contacts could be established. They were not mapped and the symbol "Jm" is used to designate the undifferentiated Morrison.

This grouping consists of alternating beds of sandstone and shale which form a uniform steep slope. The sandstones, 1 to 50 ft. thick, are cross-bedded, flat-bedded, friable to hard, calcareous, fine-grained to medium-grained, olive-green, brown, white, and gray. The shale, in the central stratigraphic section, is 57 ft. thick and is olive-green, light-green, brown, purple, and maroon. It contains thin intermittent strata of hard, calcareous sandstone.

No complete thickness of the upper Morrison beds could be measured but in the northeast corner of the North Carrizo Locality, an incomplete measurement of these beds showed at least 450 ft. to be present.

Eurida (Toh Atin) District (Ariz-cu-16, -17, -18)

The full range of the Morrison formation is disclosed in this large district lying to the west and north of those discussed above. The members have been described by Eakland in his formal report on this district and only the more pertinent features are reviewed here.

The Bluff member, a lenticular bed of white calcareous sandstone, thickens northward from 1 to 3 ft. in the Sweet-water Locality to 45 ft. in the Mexican Water Locality. It forms steep, curved, overhanging cliffs. Its lower contact is in part conformable and in part unconformable with the underlying San Rafael group as is the case in the other districts.

The Salt Wash member consists of lenticular, light-gray, 1 to 15 ft. thick, sandstones and interbedded 1 to 3 in. reddish-brown and light-green clayey shales and mudstones and sandy limestones. The sandstones are cross-bedded with good foreset stratification, locally yellow-stained, predominantly well-sorted, medium-grained, and sub-rounded quartz grains, loosely cemented with calcite and iron and containing relatively large sphere- and disk-shaped calcareous concretions in its upper beds.

SOM-vanadium mineralization is rare and spotty as would be expected from the general lack of carbonaceous material. This member is known to thin and disappear northward, and in the Mexican Water Locality where the only complete section could be measured it is only 66 to 108 ft. thick. The upper contact with the Recapture member, however, is usually somewhat indefinite.

The Recapture member, seldom completely exposed, consists of a steep slope with a few vertical ledges and thickens northward as the Salt Wash member thins. It consists of 350 to 400 ft. of maroon shales and mudstones and thin beds of hard, brown, sandy limestone or limy sandstone interbedded with cross-bedded, very friable, somewhat calcareous reddish-brown and brown, medium- to fine-grained quartzitic sandstones, 1 to 20 ft. thick.

The Westwater member outcrops as alternating vertical cliffs of sandstone and steep slopes of shale and consists of thinner light-brown to yellow-green, cross-bedded, very friable, medium-grained sandstones intercalated with yellow-green, sandy shale and mudstone of variegated red, gray, brown, orange, and purplish brown. The main distinguishing feature is the color. The thickness of this member ranges from 260 to 270 ft.

The Brushy Basin member outcrops as a steep slope, and is made up of a series of soft, variegated shales and mudstones with thin bands of harder calcareous light-gray shales. The exposures are poor but the thickness ranges from about 180 to 250 ft.

DAKOTA FORMATION - CRETACEOUS

This formation, a hard, light-yellow to yellow-brown quartzitic cobble and boulder conglomerate, was identified only in the capping on Toh Atin Mesa. The exposures are incomplete and the outcrop is a flat erosional bench bounded by jagged vertical cliffs. Dakota sandstone may also be present in the northeastern part of Sigi Ho Cho District close to the igneous intrusives, but it was not mapped or examined.

ALLUVIUM - QUATERNARY

Wind-blown sand covers most of the basement Navajo formation and much of the basal Salt Wash and underlying San Rafael group around the foot of the mesas. The northern half of the east rim of Cove Mesa and the embayments on the north and south sides of Kinusta Mesa contain such deposits. The west and southwest rims of Toh Acon Mesa are buried by wind-blown sand and locally by a thin mantle of soil. The small deposits below the northeast rim of this mesa were not mapped. In the Sigi

Ho Cho District, the alluvium is also largely wind-blown sand which was mapped in the embayments at the northeastern end where the formations dip under the valley fill and also was mapped between the Sweetwater and Emmanuel Mission Mesas.

Bench gravels were mapped on Friday and Sigi Ho Cho Mesas and also in the North and South Saytah Canyons, and Carrizo Mountains Localities and in the northern extension of Eurida Mesa. These gravels, previously considered to be Chuska conglomerate of Tertiary age, are now considered to be semi-consolidated Quaternary gravels. A section measured in South Saytah Canyon (Columnar Section No. 4) showed a 33-ft. thickness. The gravels consist of rounded boulders of quartz diorite porphyry and black limestone and pebbles of quartz and chalcedony in a loosely cemented sandy matrix. Stream gravels derived from these bench gravels were mapped in South and Lower Saytah Washes.

Igneous Rocks

Igneous rocks are found only in the northeastern quarter of Sigi Ho Cho District and in the Mexican Water Locality of the Eurida (Toh Atin) District. In the southern part of Sigi Ho Cho District, the southern extension of the sill-like intrusives of Tertiary age are exposed in the San Rafael group beds at the east end of Eurida Mesa. The igneous rock exposures can be followed northward into the Carrizo Mountains. The northern extension was copied from a map reportedly taken from a U. S. Geol. Survey map by Jensen. The rock was not examined in detail but megascopic inspection of the porphyry boulders indicated the rock to be a diorite or a quartz diorite porphyry.

In the Eurida (Toh Atin) District, Eakland reported an igneous plug, Boundary Butte, and several associated and scattered dikes.

Structure

The major structural features of the areas have a direct relationship to the Carrizo and Chuska uplifts. These uplifts, in part due to monoclinical folding and in part due to igneous intrusion, control the regional strikes and dips in the areas. Cove Mesa has an essentially flat surface based on sedimentary beds dipping $1\frac{1}{2}^{\circ}$ N. 47° W. away from the Chuska Mountains. Kinusta and Toh Acon Mesas have essentially flat-lying beds. In the Sigi Ho Cho District, the formations on the southwestern flank of the Carrizo Mountains have a higher dip due to the intrusives, 6° N. 55° W. at the Eurida Mine on Eurida Mesa.

The dip of 10 degrees at Saytah Canyon is more northerly. In the Carrizo Mountains, the formations are relatively more disturbed.

There are several broad, gently dipping, asymmetrical anticlines and synclines in the areas but most of them are too indistinct to map. The strongest and only one mapped lies at the north end of Sigi Ho Cho District along Martin Mesa. This anticline, striking N. 70° W. dies out under Toh Atin Mesa to the west. The south limb dips $\frac{1}{2}$ to 1 degree into the Carrizo uplift and the north limb dips from 1° to 5° N. at its western extension and about 12° at its eastern mapped extremity.

District Habit of Ore Occurrences

All the known occurrences of SOM-vanadium mineralization are located in the Salt Wash member of the Morrison formation and lie from 1 to 95 ft. above the base of this member. In the individual localities, the ore horizons may be in the upper or lower part of this wide zone but as a whole, the deposits are distributed erratically throughout. The highest stratigraphic ore horizons, up to 95 ft. above the base, occur in the southern districts on Cove and Kinusta Mesas. Northward, the general stratigraphic horizon decreases to 55 ft. above the base of the Salt Wash on Sunnyside Mesa, 25 ft. above in Saytah Wash, and 0 ft. in the northwest corner of the Sigi Ho Cho District and Red Mesa Locality of the Eurida (Toh Atin) District. The two main ore zones are from 10 to 45 ft. above the base and 50 to 95 ft. above the base of the Salt Wash member. The former has been the chief producer of the past due to its accessibility. The ore zones on Cove and Kinusta Mesas, 65 to 85 ft. and 75 to 95 ft., are the most intensely mineralized of all the localities not yet exploited.

The mineralization appears to have a north to northeast trend. The more intensely mineralized occurrences are on Cove Mesa and on the east side of Lower Saytah Wash. Good mineralization is also found on the west side of Kinusta Mesa and in the southwestern portion of Toh Acon Mesa.

The mineralization occurs in irregular flat beds, pods, or lenses of gray, calcareous vanadiferous sandstone with associated S-37 in or near shale seams containing fossil vegetal matter and occasional "trees".

ORE DEPOSITS

History and Production

Little is known concerning the history of these SOM-vanadium deposits of the western Carrizo Uplift and Chuska Mountains Areas prior to the 1940's. Many of the ore outcrops were probably prospected for high-grade radium ore in the preceding years but the isolation, inaccessibility, and inhospitableness of the areas have been deterrents to the active prospecting and development of the deposits.

Wade, Curran and Company of Farmington, New Mexico were the first mining operators in the areas, their first shipment of ore having been made in August, 1942. According to the records of Metals Reserve Company, the major ore buyer in recent years, about 2,942 tons of ore containing 2.23% V_2O_5 (131,211 lbs. V_2O_5) were shipped from the Martin, Saytah, and Eurida mines up to February, 1944. From May to October, 1943 Wade, Curran and Co. shipped about 475 tons of ore containing 2.57% V_2O_5 (24,395 lbs. V_2O_5) from the Sunnyside mine on Sunnyside Mesa.

The Vanadium Corporation of America operated the Rattlesnake group, Hogan, and V.C.A. No. 8 mines in the northern part of Sigi Ho Cho District from February, 1942 to February, 1944. Metals Reserve Co. records show that about 3,507 tons of ore containing 1.86% V_2O_5 (130,446 lbs. V_2O_5) were produced.

It is estimated that about 6,900 tons of ore averaging a little over 2% V_2O_5 have been produced from the areas. The incomplete figures for the SOQ content of this tonnage indicate that the average SOQ grade was about 0.15%.

Mineralization

The usual deposit is tabular and roughly follows the bedding planes of the shaly sandstone host rock. The light- to dark-gray mineralization occurs in or adjacent to carboniferous shale seams or scattered clay gall zones and frequently fades out into the host rock without a definite cut-off. The deposits are usually concentrated near carbonaceous trash piles, in shaly diastems, or near the shale seams along the edges of sandstone scours or lenses. Halo deposits around mineralized or unmineralized trees are relatively rare. The outcrops are usually long and thin, the thickness varying from 0.1 to 8.0 ft. and the lengths of outcrop from 10 to 50 times the thickness.

The stratigraphic horizons at which the ore deposits occur have been discussed under "Stratigraphy" and summarized under "District Habit of Ore Occurrences".

The predominant ore-bearing material is a gray, vanadiferous clay of the vanoxite type which usually colors the whole outcrop. Secondary in importance are carnotite, tyuyamunite, pintadoite, pascoite, rossite, and hewettite. The first two occur as specks, streaks, and stains; the others as efflorescences or fracture fillings near the surface outcrop.

Description of Occurrences

Most of the mineralized occurrences of the districts in these areas have been described or noted in the preliminary reports listed in the Introduction. Topographic plans, profile sections, and detail sketches were submitted with the preliminary reports and a large areal map, Ariz-cu-cm-5 showed the location of the occurrences and the early sample and assay data concerning them. The formal report on the Eurida (Toh Atin) District describes the few unimportant scattered occurrences found in that district and no further reference is made to them.

The old areal map, Ariz-cu-cm-5, has been replaced by newer areal geologic maps, Ariz-cu-23 and -24, and in part by Ariz-cu-15. The numbering system for the individual occurrences on the old sheet has been partially revised and supplemented on the new sheets. Furthermore, the old sample and assay data shown on the older sheet have been in part revised, corrected, and supplemented by more recent assay and sample information. A cross-reference to the sample and assay data may be found in the Appendix. Therefore, the old areal map need not be used in reference to this summary and supplemental report.

This report has summarized, corrected, and revised all the data, old and new, that have been accumulated from the various field examinations of the SOM-vanadium occurrences in the Chuska Mountains and western Carrizo Uplift Areas. In order to avoid unnecessary repetitions of the descriptions and in order to correlate and simplify the accumulated information, a cross-reference table has been made giving reference to where the preliminary and/or new data on the individual occurrences may be found and giving details of modified or new descriptive notes.

These tables are divided into the respective areas, districts, and localities and the number or name of the showing, outcrop, or mine is the same as designated on the accompanying

areal maps. The maps or pages listed under "Old Sketch" refer to map sheets submitted with the preliminary reports or to pages in the folder of topographic plans, profile sections, and detail sketches which was submitted with the preliminary reports. The "New Figure" refers to the sheets or figures submitted with this report which supplement or replace the older sketches. Under "Old Descrip." will be found reference to where the old descriptions of the individual occurrence may be found in the preliminary reports. Where noted "On Map", the old description is to be found on the map sheet or page listed under "Old Sketch"; where noted, Prelim. Rpt., the following number refers to the particular report in which this occurrence is described, as designated in the Introduction and repeated below in reference to districts and localities. Under notes, the status of the description data is summarized in capital letters. Thus, REVISED means that the preliminary data have been replaced in part or entirely by new data; UNCHANGED means that the old data have not been revised; and NEW means that the data are of recent date and have not been previously reported.

Not all of the old sample and assay data, i.e., taken during the fall of 1943 and up through the spring of 1944, are posted on the newer maps. In most cases these can only be found posted on the old areal map, Ariz-cu-cm-5. Only those older samples having a pertinent value to this summary and supplemental report have been reposted. All the new sample and assay data have been posted. It must be noted in respect to the older assays that the SOQ values shown on the older maps were assayed by Burlingame and that newer and more reliable SOQ assays by Tonawanda on the same pulps have replaced those older values. As mentioned previously, a complete reference to sample and assay data can be found in the Appendix.

CHUSKA MOUNTAINS AREA

Cove District

The preliminary report by A. H. Coleman, "Description of Ore Outcrops on Cove Mesa and Two Small Mesas South of Cove Mesa, Apache County, Arizona" (No. 4) and the two large sheets of detail sketches, Ariz-cm-2 and -3, have been previously submitted.

The present report on this district includes a revised areal geology map, Ariz-cm-1, and new detail sketches and maps, Figure Nos. 3 to 12 inclusive. The two small mesas to the south of Cove Mesa, although shown on the revised areal map, were not re-examined and the description of their ore occurrences remains unchanged from the preliminary report.

Revised descriptive notes are given for 3 of the showings. These and other revisions, corrections, or changes are noted on the cross-reference table for this district. No attempt has been made to correct the detail sketches appearing on the old sheets, Ariz-cm-2 and -3, but important corrections or supplemental notes are given under "Notes" in the table.

Mexican Cry Mesa District

The preliminary report, "Mexican Cry Mesa" by A. H. Coleman, has been submitted and the ore occurrences described in this report have not been changed. No further mention of this district will be made in this report and its position and showings only appear on the old areal map, Ariz-cu-cm-5.

CARRIZO UPLIFT AREA

Kinusta District

The preliminary reports, "Kinusta Mesa (Showings 1-14)" (No. 2) and "Kinusta, Toh Acon and Eurida Districts" (No. 1), by E. H. Eakland, Jr. et al and accompanying profile sections and detail sketches on pages 1 to 12 inclusive of the map folder have been previously submitted.

To accompany this report of the district, two new sheets, Ariz-cu-25 (Kinusta Mesa, Plot E) and Ariz-cu-26 (Kinusta Mesa, Detail Sketches of Outcrops) have been made. Many of the old small sketches have been revised in the new Figure Nos. 13 to 23 inclusive and revised descriptive notes have been made for showings K-16, -16A. These and other changes are noted in the cross-reference table for this district.

Toh Acon District

The preliminary report "Kinusta, Toh Acon and Eurida Districts" (No. 1) by E. H. Eakland, Jr. et al, describes outcrops A-1 thru A-7. Their location was shown on the old areal map, Ariz-cu-cm-5. Additional notes were taken by Party No. 3 in the Spring of 1944 and are presented here for the first time.

To accompany this report on the district, an areal geologic map, Ariz-cu-15, has been made. The older descriptions remain unchanged and the new additional descriptions are given in the notes in the cross-reference table for this district.

Sigi Ho Cho District

Sigi Ho Cho Mesa Locality: A preliminary report, "Sigi Ho Cho, Altar, Friday, and Eurida Mesas" (No. 3) by F. X. Corbett, and the accompanying topographic plans, profile sections and detail sketches on pages 14 thru 47 in the old map folder have been previously submitted.

To accompany the present report on this locality, a new areal map, Ariz-cu-27, showing the Union Mines Development Corp. leased plots B, C, and D has been added. One new figure, No. 24,

of Outcrop No. 8A probably replaces the older designated Outcrop No. 9. All other descriptions and sketches remain unchanged. Reference is made to the source of the information in the table of ore occurrences for this locality.

Friday Mesa Locality: The preliminary report (No. 3) by F. X. Corbett, mentioned above, and pages 56 through 60 of the old map folder describe the three ore occurrences in this locality. There are no changes or additional data as shown in the cross-reference table for this locality.

Sunnyside Mesa Locality: The preliminary report (No. 3) by F. X. Corbett, mentioned above, covered the 3 outcrops and the Sunnyside mine in this locality. Plans, sections, and sketches were shown on pages 48 thru 55 in the old map folder. The outcrop descriptions and sketches are unchanged but the data on the Sunnyside mine have been revised as shown in the cross-reference table for this locality.

Eurida Mesa Locality: F. X. Corbett's preliminary report (No. 3) and the sketches, etc. on pages 61 thru 65 in the old map folder described the ore occurrences in this locality. These remain unchanged in this report as shown in the table for this locality.

Eurida Mesa Locality: The preliminary report by F. X. Corbett (No. 3) and the sketches, etc. on pages 66 thru 88 in the old map folder describe most of the ore occurrences and mines of this locality.

To accompany this report, a new areal map, Ariz-cu-28, showing the location of the old claims and the new Union Mines Development Corp. leased plot, has been made. New Figure Nos. 26 thru 31 have been drawn to revise the older descriptions and sketches and to show one new occurrence, the VCA pits at the east end of Eurida Mesa. A revised description of the Eurida mine has also been noted. These changes and additions are shown on the cross-reference table for this locality.

North and South Saytah Canyon Localities: The preliminary report, "Kinusta, Toh Acon and Eurida Districts" (No. 1) by E. H. Eakland, Jr. et al and the sketches on page 13 of the old map folder have been previously submitted.

The new Figure Nos. 32, 33, and 34 have revised some of the earlier maps, sketches, and descriptions and the areal map, Fig. No. 35, shows the localities in more detail. The changes and additions are shown on the cross-reference table for this locality.

Carrizo Mountains Locality: The description of the ore occurrences in this locality has not been previously submitted

although the examination was made by Party No. 3 in the Spring of 1944. The notes on the two occurrences found are given in the table for this locality.

About 4500 ft. of Morrison Salt Wash member outcrops high on the west flank of the Carrizo Mountains. The beds strike about N. 45° E. and dip 14° to 16° NW. About 75 ft. of the total thickness of the member is exposed, overlying the red-brown and orange silty sandstone of the San Rafael group and overlain by the sandstone and shale of the upper Morrison formation. The latter has been intruded by the Carrizo intrusives. To the east, the Salt Wash is covered by talus and between this locality and the Saytah Canyon localities, the Salt Wash is covered by the gravels of an old land surface. The locality is in part accessible by an unimproved dirt road but the mineralization in it is, at present, economically unimportant.

Martin Mesa Locality: In the preliminary report, "Kinusta, Toh Acon and Eurida Districts" (No. 1) by E. H. Eakland, Jr., et al, the ore occurrences of this locality were described.

In the present report, Figure Nos. 36 thru 40 revise some of the older descriptions and new descriptions were written for the Saytah, North Martin and Hogan mines and for the Martin mine. These changes and notes are shown on the table for this locality.

North Carrizo Locality: The descriptions of the ore occurrences in this locality have not been previously reported although the preliminary field work was done by Party No. 3 in the Spring of 1944. This earlier work has been checked and supplemented during the more recent field examination. An areal map of the Rattlesnake group, Ariz-cu-29, and a sheet of detail sketches of the occurrences in the Rattlesnake group, Ariz-cu-30, have been made. Figure Nos. 37 and 41 thru 47 show the details of some of the other mines and ore occurrences. Descriptive notes have also been made of all occurrences and mines. These data are all shown on the cross-reference table for this locality.

The mineralization in the North Carrizo Locality is very extensive with upwards of 100 separate outcrops found. The Vanadium Corp. of America holds 8 claims in this locality and has opened up most of the promising showings. The main outcrops have an estimated grade of about 2% V₂O₅ but most showings tend to pinch in width and decline in grade very rapidly when followed inward from their outcrops.

The Rattlesnake group lies on the north limb of an asymmetrical anticline and the northernmost deposits are buried under valley alluvium. The ore horizon beds have an average

dip of about 7° N. 20° E. and lie stratigraphically from 10 to 16 ft. above the base of the Salt Wash member.

CONDITIONS AFFECTING MINING

Legal Conditions

Mining rights and operations on a U. S. Indian Reservation are subject to different laws and rules than those in force for ordinary open mining land. Some of these regulations are noted below.

All mineral resources on the Navajo Indian Reservation are owned, theoretically, by the Navajo Indians. Mining rights may be acquired from the U. S. Indian Service, Department of the Interior, which administers the business affairs of the Indians.

Before any leases may be acquired, the expectant lessee must designate for the information of the U. S. Indian Service an area which he desires to prospect for mineral values. Thereupon, the Indian Service puts the designated area up for public auction and all interested persons are invited to bid on the lease. The highest bidder acquires the prospecting lease and is given a stated time, usually 6 to 12 months, in which to prospect the lease and to designate that portion of the lease which he desires to acquire.

Surveys of the desired portion of the lease must be submitted to the U. S. Indian Service for the approval of the Department of the Interior. Providing that the Department of the Interior gives its approval, the lessee holds the mineral rights to the land, subject to numerous conditions. A complete set of the conditions may be obtained from the U. S. Indian Service and only a few are outlined here.

The lessee must use Indian labor in all unskilled jobs, including truck-driving, mining, and mucking. He must pay an annual advance rental which is considered as an advance royalty payment and which may be deducted from the royalties due on the ore mined. The monthly royalties are based on the value of the products produced. Any ore must be milled on the Reservation except by special permission of the Secretary of the Interior. Within a year of the approval of the lease, the lessee must have expended a set sum of money in the development of the lease and must continue development and operation in an orderly fashion thereafter. Mining operations cannot be suspended without the cancellation of the lease except with permission

CHUSKA MOUNTAINS AREA, COVE DISTRICT
Cross Reference and Descriptions of Ore Occurrences

following page 31

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
S-1	Ariz-cm-2	---	On Map	UNCHANGED - #4 sample width should read 3 ft.
S-2	---	---	Prelim.Rpt.#4	UNCHANGED
S-3	Ariz-cm-2	---	On Map	UNCHANGED - #2 sample has width of 1.8 ft.
S-4	Ariz-cm-2	Fig.No.8	On Map	REVISED
S-5	---	Fig.No.10	Prelim.Rpt.#4	REVISED
S-6	---	---	Prelim.Rpt.#4	UNCHANGED
S-7	---	---	Prelim.Rpt.#4	UNCHANGED
S-8	---	---	Prelim.Rpt.#4	UNCHANGED
S-9	---	Fig.No.10	Prelim.Rpt.#4	REVISED
S-10	---	---	Prelim.Rpt.#4	UNCHANGED
S-11	Ariz-cm-2	Fig.No.9	On Map	REVISED
S-12	Ariz-cm-2	---	On Map	UNCHANGED
S-13	Ariz-cm-2	---	On Map	UNCHANGED
S-14	---	Fig.No.9	Prelim.Rpt.#4	REVISED
S-15	Ariz-cm-2	---	On Map	REVISED - Thin-bedded, cross-bedded fine-grained, gray, calcareous sandstone impregnated with disseminated carnotite.
S-16	---	---	Prelim.Rpt.#4	REVISED - 1 ft. by 1 ft. patch of poorly exposed vanadiferous sandstone.
S-17	Ariz-cm-2	Fig.No.9	On Map	REVISED
S-18	Ariz-cm-3	---	On Map	UNCHANGED
S-19	---	---	Prelim.Rpt.#4	UNCHANGED
S-20	Ariz-cm-3	---	On Map	UNCHANGED
S-21	---	---	Prelim.Rpt.#4	UNCHANGED - not located on maps
S-22	---	---	Prelim.Rpt.#4	UNCHANGED
S-23	---	---	Prelim.Rpt.#4	UNCHANGED
S-24	Ariz-cm-3	---	On Map	UNCHANGED
S-25	Ariz-cm-3	---	On Map	UNCHANGED
S-26	---	Fig.No.8	Prelim.Rpt.#4	REVISED

CHUSKA MOUNTAINS AREA, COVE DISTRICT - cont.

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
S-27	---	Fig.No.8	Prelim.Rpt.#4	REVISED
S-28	Ariz-cm-3	Fig.No.7	Prelim.Rpt.#4	REVISED
S-28A	---	Fig.No.7	---	NEW
S-29	---	---	Prelim.Rpt.#4	REVISED - 1 ft. by 1 ft. poorly exposed vanadiferous sandstone.
S-30	---	Fig.No.4	Prelim.Rpt.#4	REVISED
S-31	---	Fig.No.6	Prelim.Rpt.#4	REVISED
S-32	Ariz-cm-3	Fig.No.6	Prelim.Rpt.#4	REVISED
S-33	---	Fig.No.6	Prelim.Rpt.#4	REVISED
S-34	---	---	Prelim.Rpt.#4	UNCHANGED
S-35	---	---	Prelim.Rpt.#4	UNCHANGED
S-36	---	---	Prelim.Rpt.#4	UNCHANGED
S-37	---	---	Prelim.Rpt.#4	UNCHANGED
S-38	Ariz-cm-3	---	Prelim.Rpt.#4	UNCHANGED -- Estimated grades V ₂ O ₅ shown.
S-39	---	Fig.No.5	Prelim.Rpt.#4	REVISED
S-40	---	Fig.No.5	Prelim.Rpt.#4	REVISED
S-41	---	---	Prelim.Rpt.#4	UNCHANGED
S-42	Ariz-cm-3	---	Prelim.Rpt.#4	UNCHANGED -- Estimated grades V ₂ O ₅ shown.
S-42A	---	Fig.No.4	---	NEW
S-43	---	---	Prelim.Rpt.#4	UNCHANGED
S-44	Ariz-cm-3	Fig.No.3	Prelim.Rpt.#4	REVISED
S-45	---	Fig.No.4	Prelim.Rpt.#4	REVISED
S-46	---	---	Prelim.Rpt.#4	UNCHANGED
S-47	---	---	Prelim.Rpt.#4	UNCHANGED
S-48	Ariz-cm-3	Fig.No.3	Prelim.Rpt.#4	REVISED
S-49	---	Fig.No.12	Prelim.Rpt.#4	REVISED
S-50	---	Fig.No.8	Prelim.Rpt.#4	REVISED
S-51	---	Fig.No.11	Prelim.Rpt.#4	REVISED
S-52	---	Fig.No.11	Prelim.Rpt.#4	REVISED
S-53	---	Fig.No.11	Prelim.Rpt.#4	REVISED
S-54	---	---	Prelim.Rpt.#4	UNCHANGED
S-55	---	---	Prelim.Rpt.#4	UNCHANGED

CHUSKA MOUNTAINS AREA, COVE DISTRICT - contd.

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Note</u>
S-56	----	----	Prelim.Rpt.#4	UNCHANGED
S-57	----	----	Prelim.Rpt.#4	UNCHANGED
S-58	----	----	Prelim.Rpt.#4	UNCHANGED
S-59	----	Fig.No.10	Prelim.Rpt.#4	REVISED

CARRIZO UPLIFT AREA, KINUSTA DISTRICT
Cross Reference and Descriptions of Ore Occurrences

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
K-1	Page 2	Fig.No.13	Prelim.Rpt.#2	REVISED
K-2	Pages 2,3	Ariz-cu-26		
		Fig.Nos.14, 15	Prelim.Rpt.#2	REVISED
K-3	Page 5	Fig.No.16	Prelim.Rpt.#2	REVISED
K-4	Page 5	Fig.No.16	Prelim.Rpt.#2	REVISED
K-5	Page 6	Fig.No.17	Prelim.Rpt.#2	REVISED
K-6	Page 6	Fig.No.17	Prelim.Rpt.#2	REVISED
K-7	Page 7	Fig.No.18	Prelim.Rpt.#2	REVISED
K-8	Page 8	Fig.No.19	Prelim.Rpt.#2	REVISED
K-9	Page 8	Fig.No.19	Prelim.Rpt.#2	REVISED
K-10	---	---	---	REVISED - No outcrop found.
K-10A	---	---	Prelim.Rpt.#2	UNCHANGED
K-11	---	---	Prelim.Rpt.#2	UNCHANGED
K-12	---	---	Prelim.Rpt.#2	UNCHANGED
K-13	---	---	Prelim.Rpt.#2	UNCHANGED
K-14	---	Ariz-cu-26	Prelim.Rpt.#2	UNCHANGED
K-15	---	---	Prelim.Rpt.#2	UNCHANGED
K-16, 16A	---	---	Prelim.Rpt.#1	REVISED - K-16 monument near 1 sq. ft. outcrop of vanadiferous sandstone float obscured by alluvium. K-16A is 10 ft. higher stratigraphically on 105 ft. of talus-obscured, intermittent E.-W. outcrops. Main showing consists of 10 ft. by avg. 0.5 ft. lens and 5 and 10 ft. by 0.7 ft. patches with an overall average length and thickness of 25 ft. by 0.6 ft. Low-grade, platy, gray to brown vanadiferous sandstone.
K-17	Page 9	Fig.No.20	Prelim.Rpt.#1	REVISED AND SUPPLEMENTED
K-18	Page 9	Fig.No.20	Prelim.Rpt.#1	REVISED AND SUPPLEMENTED
K-19	---	---	Prelim.Rpt.#1	UNCHANGED

CARRIZO UPLIFT AREA, KINUSTA DISTRICT - contd.

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
K-20	---	---	Prelim.Rpt.#1	UNCHANGED
K-21	Page 10	Fig.No.21	Prelim.Rpt.#1	REVISED
K-22	---	---	Prelim.Rpt.#1	UNCHANGED
K-23	Page 10	Fig.No.21	Prelim.Rpt.#1	REVISED AND SUPPLEMENTED
K-24	Page 11	Fig.No.22	Prelim.Rpt.#1	REVISED AND SUPPLEMENTED
K-25	---	Ariz-cu-26	Prelim.Rpt.#1	REVISED AND SUPPLEMENTED
K-26	---	Ariz-cu-26	Prelim.Rpt.#1	REVISED AND SUPPLEMENTED
K-27	Page 12	Ariz-cu-26	Prelim.Rpt.#1	REVISED AND SUPPLEMENTED
		Fig.No.23	Prelim.Rpt.#1	REVISED AND SUPPLEMENTED
K-28	---	Ariz-cu-26	Prelim.Rpt.#1	REVISED

CARRIZO UPLIFT AREA, TOH ACON DISTRICT
Cross Reference and Descriptions of Ore Occurrences

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
A-1	---	---	Prelim.Rpt.#1	UNCHANGED
A-2	---	---	Prelim.Rpt.#1	UNCHANGED
A-3	---	---	Prelim.Rpt.#1	UNCHANGED
A-4	---	---	Prelim.Rpt.#1	UNCHANGED
A-5	---	---	Prelim.Rpt.#1	UNCHANGED
A-6	---	---	Prelim.Rpt.#1	UNCHANGED
A-7	---	---	Prelim.Rpt.#1	UNCHANGED
A-8	---	---	---	NEW - 90 ft. lensing outcrop, avg. thickness 0.5 ft., vanadiferous mineralization with no visible carnotite in gently cross-bedded, gray-white, moderately thick-bedded sandstone. Ore locally in or under 1.7 ft. bed of layered 1/2-in., reddish-brown clay galls and several 6-in. tree fragments. Avg. grade better than 1% V ₂ O ₅ outcrop is about 45 ft. above base of Salt Wash.
A-9	---	Ariz-cu-15	---	NEW - 540 ft. of lensing and splitting, intermittent outcrops of vanadiferous sandstone with some disseminated carnotite. Avg. thickness about 2 ft. Predominantly thick-bedded (0.5-3.0 ft.) gently to steeply cross-bedded, gray-white sandstone. Locally, vanoxite-type ore has 1-ft. zone of thin layers of small maroon clay galls. Outcrop is about 81 ft. above base of Salt Wash. Avg. grade a little better than 1% V ₂ O ₅ .
A-10	----	---	----	NEW - 18 ft. lensing outcrop vanadiferous sandstone. Avg. thickness 0.5 ft. Maximum 1 ft. No visible carnotite. At

CARRIZO UPLIFT AREA, TOH ACON DISTRICT - contd.

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
				southeastern end shiny black coatings on sand grains. At northwestern end limy concretions 1 in. in diameter. Grade about 1% V ₂ O ₅ . Outcrop about 45 ft. above base of Salt Wash.
				About 250 ft. NW. and 2 ft. lower stratigraphically, similar 12 ft. outcrop with avg. thickness of 0.5 ft. and about 1% V ₂ O ₅ .
A-11	---	---	---	NEW - 3, 1/4 to 1/2 ft., bands outcrop intermittently over 25 ft. inaccessible outcrop. No visible carnotite. Dark purple, iron-stained bands with ore. Grade less than 1% V ₂ O ₅ . Outcrop about 52 ft. above base of Salt Wash.
A-12	---	---	---	NEW - 55 ft. E.-W., lensing outcrop of vanadiferous sandstone. Avg. thickness about 0.7 ft., maximum 1 ft. Locally abundant calcareous concretions 1/4 in. in diameter and brown, iron-stained bands. Grade less than 1% V ₂ O ₅ . Outcrop about 58 ft. above base of Salt Wash in gray-brown, gently cross-bedded sandstone. Beds avg. 2 ft. in thickness. 250 ft. N. 80° W., 8 ft. by 12 ft. outcrop of float vanoxite-type ore with disseminated carnotite. Same horizon. Grade less than 1% V ₂ O ₅ .
A-13	---	---	---	NEW - 3 talus blocks of gray-white sandstone contain 0.3 to 0.7 ft. bands of high-grade (2% to 3% V ₂ O ₅) vanoxite-type ore. None found in place.
A-14	---	---	---	NEW - 25 ft. outcrop vanadiferous sandstone. Avg. thickness about 0.7 ft. Minor

CARRIZO UPLIFT AREA, TOH ACON DISTRICT - contd.

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
				visible carnotite. Host rock is cliff-forming, light-gray sandstone with considerable calcareous cement. Generally flat-bedded, thick-bedded (2 to 4 ft.), medium-grained. Interbedded 4 to 6 in. clay seams. Avg. grade about 1.5% V ₂ O ₅ . Outcrop about 29 ft. above base of Salt Wash.
A-15	---	---	---	NEW - Irregular, up to 2 ft., vanoxite-type with abundant carnotite halo around calcified, unmineralized, 2 ft. by 0.5 ft. oval logs. Heavy purple (Fe, Mn?) staining. Grade decreases outward from 2% to 3% V ₂ O ₅ . Sample.
A-16	---	---	---	NEW - Weak vanoxite-type halos and disseminations with no carnotite around two 0.7-0.8 ft. diameter log casts 1 ft. apart and vegetal remains. Inaccessible, 17 ft. above talus slope. Grade about 0.5% to 1.0% V ₂ O ₅ .

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, SIGI HO CHO MESA LOCALITY
Gross Reference and Descriptions of Ore Occurrences

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
Otc. #1(7)	pp. 14, 26, 46	---	Prelim. Rpt. #3	UNCHANGED
Otc. #2	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #3(6)	pp. 15, 27, 38	---	Prelim. Rpt. #3	UNCHANGED
Otc. #4(8)	pp. 16, 28, 38	---	Prelim. Rpt. #3	UNCHANGED
Otc. #5	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #6	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #7(11)	pp. 17, 29, 39-41	---	Prelim. Rpt. #3	UNCHANGED
Otc. #8	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #8A	---	Fig. No. 24	Prelim. Rpt. #3	REVISED - Probably same location as #9 on Ariz-cu-cm-5
Otc. 9A(9)	pp. 18, 30, 42	---	---	UNCHANGED
Otc. #10	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #11	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #12	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #13(10)	pp. 19, 31, 43	---	Prelim. Rpt. #3	UNCHANGED
Otc. #14(1)	pp. 20, 32, 44	---	Prelim. Rpt. #3	UNCHANGED
Otc. #15(2)	pp. 21, 33, 44	---	Prelim. Rpt. #3	UNCHANGED
Otc. #17(3)	pp. 22, 34, 45	---	Prelim. Rpt. #3	UNCHANGED
Otc. #18(4)	pp. 23, 35, 45	---	Prelim. Rpt. #3	UNCHANGED
Otc. #20	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #21	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #22	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #23	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #24(5)	pp. 24, 36, 46	---	Prelim. Rpt. #3	UNCHANGED
Otc. #40(12)	pp. 25, 37, 47	---	Prelim. Rpt. #3	UNCHANGED

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, FRIDAY MESA LOCALITY

Otc. #25	---	---	Prelim. Rpt. #3	UNCHANGED
Otc. #26(2)	pp. 56, 58, 60	---	Prelim. Rpt. #3	UNCHANGED
Otc. #26A(1)	pp. 57, 59, 60	---	Prelim. Rpt. #3	UNCHANGED

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, SUNNYSIDE MESA LOCALITY
Cross Reference and Descriptions of Ore Occurrences

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
Otc.#27	---	----	Prelim.Rpt.#3	UNCHANGED
Otc.#28	---	---	Prelim.Rpt.#3	UNCHANGED
Otc.#29(1)	pp.48,50,53	---	Prelim.Rpt.#3	UNCHANGED
Sunnyside Mine	pp.49,51,52,54,55	Fig.No.25	----	REVISED - N.-S. elongated ore body of gray, calcareous, vanadiferous sandstone and varied amounts of disseminated carnottite concentrated around mineralized trees and vegetal trash. Lenticular, irregular ore seams usually near or along small shale or carbonaceous shaly sandstone seams. Greatest thickness and best grade of ore near portals. Outcrop lies about 53 ft. above base of Salt Wash. Operated by Wade-Curran & Co.

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, ALTAR MESA LOCALITY

Otc.#30	pp.61,63,65	---	Prelim.Rpt.#3	UNCHANGED
Otc.#31	---	---	Prelim.Rpt.#3	UNCHANGED
Otc.#32	---	---	Prelim.Rpt.#3	UNCHANGED
Otc.#33	---	---	Prelim.Rpt.#3	UNCHANGED
Otc.#34	pp.62,64,65	---	Prelim.Rpt.#3	UNCHANGED

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, EURIDA MESA LOCALITY

Otc.#35	----	Fig.No.31	Prelim.Rpt.#3	REVISED
Otc.#36	----	---	Prelim.Rpt.#3	UNCHANGED
Otc.#37	----	Fig.No.31	Prelim.Rpt.#3	REVISED

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, EURIDA MESA LOCALITY - contd.

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
Otc.#38	----	---	Prelim.Rpt.#3	UNCHANGED
Otc.#39(1)	pp.72,78,88	---	Prelim.Rpt.#3	UNCHANGED
Eurida Mine	pp.67,68,73,74, 79,80	Fig.No.26	---	REVISED - Series of lenticular, irregular seams of gray, friable, calcareous, vanadiferous sand- stone. Abundant disseminated carnotite near northwest portals. Numerous contorted shale and mudstone beds in northwest por- tion. Few scattered mineralized trees and associated halos.
Eurida Mine	pp.69,75,81			
E. Workings	pp.82	Fig.No.27	---	REVISED
VCA Pits				
E.End Eurida	---	Fig.No.28	---	NEW
Mesa				
VCA Workings				
Eurida Claim	pp.70,76, 83-85	Fig.No.30	---	REVISED
VCA Workings	pp.71,77,86,			
Eurida #2	87	Fig.No.29	---	REVISED

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, N. & S. SAYTAH CANYON LOCALITIES
Cross Reference and Descriptions of Ore Occurrences

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
S-1	----	Fig.No.33	Prelim.Rpt.#1	REVISED - Mined out; uneconomic thick- ness of mineralization left.
S-2	----	----	Prelim.Rpt.#1	UNCHANGED
S-3	Page 13	Fig.No.34	Prelim.Rpt.#1	REVISED
S-4	----	----	Prelim.Rpt.#1	UNCHANGED
S-5	----	----	Prelim.Rpt.#1	UNCHANGED
S-6	----	----	Prelim.Rpt.#1	UNCHANGED
S-10	----	----	Prelim.Rpt.#1	UNCHANGED
S-11	----	----	Prelim.Rpt.#1	UNCHANGED
T-1	----	----	Prelim.Rpt.#1	UNCHANGED
T-2	----	----	Prelim.Rpt.#1	UNCHANGED
T-3	----	----	Prelim.Rpt.#1	UNCHANGED
CBW-MC	Page 13	Fig.No.32	Prelim.Rpt.#1	REVISED - Mined out; uneconomic thick- ness of mineralization left.
CBW-#10	----	----	Prelim.Rpt.#1	UNCHANGED
CBW-#11	----	----	Prelim.Rpt.#1	UNCHANGED
CBW-#12	----	----	Prelim.Rpt.#1	UNCHANGED
CBW-#13	----	----	Prelim.Rpt.#1	UNCHANGED
CBW-#14	----	----	Prelim.Rpt.#1	UNCHANGED
CBW-#15	----	Fig.No.33	Prelim.Rpt.#1	REVISED - Sufficiently developed to show no extent to mineralization
CBW-#16	----	----	Prelim.Rpt.#1	UNCHANGED
CBW-#17	----	----	Prelim.Rpt.#1	UNCHANGED
CBW-#18	----	----	Prelim.Rpt.#1	UNCHANGED
CBW-#19	----	----	Prelim.Rpt.#1	UNCHANGED

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, CARRIZO MOUNTAIN LOCALITY

CM-1	----	----	----	NEW -- 90-ft. outcrop with 20 ft. barren of vanoxite-type ore with minor carno- tite about 26 to 33 ft. above base of Salt Wash. Main mineralization occurs
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CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, CARRIZO MOUNTAINS LOCALITY -- contd.

<u>Showing</u>	<u>Old Sketch</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
				as halos around 5 or 6 tree casts (1 ft. in diameter) at top of 3-ft. thick lens of cross-bedded, well-cemented, light-gray, calcareous, coarse-grained sandstone. Tree remains silicified, iron-stained, and mineralized. Grade less than 1% V ₂ O ₅ . Intermittently covered with talus, 0.5-ft. band of 1% V ₂ O ₅ ore lies at base of 4 ft. shaly sandstone underlying sandstone lens. About 250 ft. E., vanoxite-type float found at same horizon. No ore found in place.
CM-2	----	----	---	Sample 3013 (1421) cut at main showing. NEW - 15 ft. outcrop, average 1/4 ft. thick, of about 1.5% V ₂ O ₅ and no visible carnotite in thin (4-in.) bedded, light-gray, well-cemented sandstone, about 29 ft. above base of Salt Wash. About 200 ft. E., sandstone float contains some disseminated carnotite.

CARRIZO UPLIFT AREA, SIGI HO DISTRICT, MARTIN MESA LOCALITY

M-1	----	Prelim.Rpt.#1	UNCHANGED
M-2	----	Prelim.Rpt.#1	UNCHANGED
M-3	Fig.No.37	Prelim.Rpt.#1	REVISED
M-5	----	Prelim.Rpt.#1	UNCHANGED
M-6	----	Prelim.Rpt.#1	UNCHANGED
M-7	----	Prelim.Rpt.#1	UNCHANGED
M-8	----	Prelim.Rpt.#1	UNCHANGED

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, MARTIN MESA LOCALITY - contd.

<u>Showing</u>	<u>New Figure</u>	<u>Old Descrip.</u>	<u>Notes</u>
M-9	---	Prelim.Rpt.#1	UNCHANGED
M-10	---	Prelim.Rpt.#1	UNCHANGED
M-11	---	Prelim.Rpt.#1	UNCHANGED
M-12	---	Prelim.Rpt.#1	UNCHANGED
M-13	---	Prelim.Rpt.#1	UNCHANGED
M-16	---	Prelim.Rpt.#1	UNCHANGED
M-17	---	Prelim.Rpt.#1	UNCHANGED
M-18	---	Prelim.Rpt.#1	UNCHANGED
M-19	---	Prelim.Rpt.#1	UNCHANGED
M-20	---	Prelim.Rpt.#1	UNCHANGED
M-21	---	Prelim.Rpt.#1	UNCHANGED
Saytah Mine			
	Fig.No.40	---	NEW - Small mines, essentially development work. Few scattered mineralized trees with local small
North Martin			
Mine	Fig.No.38	---	pockets of good ore mined out in or along shale
Hogan			
Mine	Fig.No.36	---	and shaly sandstone seams containing scattered carbonaceous vegetal trash. Tree halos and streaks and spots of hard calcareous vanadiferous sandstone.
Martin			
Mine	Fig.No.39	---	NEW - Largest mine of locality. Extensively mined by Wade, Curran & Co. E.-W. elongated ore body of vanadiferous sandstone with disseminated carnotite. Ore thickest and of best grade along outcrop. Thins to west and abruptly pinches out to north. Essentially usually thin, irregular, lenticular stringers or seams in or along shale seams.

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, NORTH CARRIZO LOCALITY
Cross Reference and Descriptions of Ore Occurrences

<u>Showing</u>	<u>New Figure</u>	<u>Notes</u>
NC-1	---	NEW - 25 ft. outcrop. Avg. thickness 1 ft., maximum 2 ft. Vanoxite type with minor carnotite in shaly sandstone intercalated between lenses of gently cross-bedded, medium hard, light-gray, somewhat calcareous sandstone with numerous 1/4-in. clay galls. Avg. est. grade 0.5% to 1.0% V ₂ O ₅ . Outcrop about 30 ft. above base of Salt Wash.
NC-2	Fig.No.43	NEW - Medium-hard sandstone. Occasional clay galls. Avg. est. grade 1.5% V ₂ O ₅ . Outcrop about 25 ft. above base of Salt Wash. Several small traces of vanoxite-type at ends of main ore outcrop.
NC-3	Fig.No.37	NEW - Vanoxite-type ore with very minor visible carnotite in and around a shaly sandstone parting between lenses of cross-bedded, somewhat calcareous, light-gray sandstone. Avg. thickness of ore about 2 ft. Avg. estimated grade 1.75% V ₂ O ₅ .
NC-4	---	NEW - 37 ft. lens of estimated avg. grade of 0.75% V ₂ O ₅ . Avg. width 0.5 ft., maximum 1 ft. Occurs in 2 ft. shaly sandstone seam about 23 ft. above base of Salt Wash.
NC-5	---	NEW - Two low-grade vanoxite-type outcrops in same horizon 40 ft. above base of Salt Wash and 10 ft. apart. South outcrop 35 ft. long with avg. thickness of 0.2 ft., maximum 0.5 ft. North outcrop 25 ft. long, avg. thickness of 0.3 ft., maximum 0.5 ft. Both occur in an 8-ft. gently cross-bedded, hard, light-gray, somewhat calcareous sandstone lens.
NC-6	---	NEW - Two outcrops, 35 ft. apart and about 43 ft. above base of Salt Wash. South outcrop 22 ft. long, avg. thickness 0.5 to 0.8 ft., maximum 1.9 ft. Low-grade vanoxite type with no visible carnotite but high in lime. North outcrop 16 ft. long, avg. thickness 0.5 ft., maximum 1.3 ft. Sample 3009 cut at south end of north outcrop. Both in cross-bedded, hard, light-gray sandstone with underlying sandy, brown and green shale.
NC-7	---	NEW - 15 ft. outcrop, avg. thickness 0.5 ft., of low-grade vanoxite type in shaly, medium-hard sandstone seam between lenses of cross-bedded, hard, light-gray sandstone. No visible carnotite. Ore horizon about 83 ft. above base of Salt Wash.
(NC-7A)		

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, NORTH CARRIZO LOCATION - contd.

<u>Showing</u>	<u>New Figure</u>	<u>Notes</u>
NC-8	---	NEW - 29 ft. outcrop, avg. thickness 0.8 ft. and maximum 1.5 ft. of vanoxite type with minor, spotty carnotite. Lensing, splitting and intermittent bands, 33 to 37 ft. above base of Salt Wash, either in clay and shaly sandstone between sandstone lenses or in cross-bedded, thin-bedded, generally calcareous, medium-grained sandstone with scattered calcified vegetal remains. Grade avg. about 1% V ₂ O ₅ .
NC-9	---	NEW - 31 ft. outcrop, avg. thickness 0.3 ft. of vanoxite type with some weakly disseminated carnotite confined to a 0.2 to 1.6 ft. sandy shale seam with numerous clay galls and occasional vegetal remains between lenses of cross-bedded, light-gray, calcareous sandstone. Ore horizon about 23 ft. above base of Salt Wash. Estimated grade 1% V ₂ O ₅ . Sample 3012 cut 17 ft. from north end.
NC-10	---	NEW - Elliptical pocket (3.3 ft. by 1 ft.) around cast of 1.1 ft. tree. Considerable disseminated carnotite. Avg. grade about 1% V ₂ O ₅ . Ore about 35 ft. above base of Salt Wash. 1.3 ft. above is 0.5 ft. band of clayey sandstone spotted and streaked with better than 1% V ₂ O ₅ for 5 ft. Host rock is cross-bedded, light-brown, medium grained sandstone with numerous light-green clay seams.
NC-11	---	NEW - 7-ft. outcrop, avg. 0.3 ft. thickness, banded vanoxite type with weakly disseminated carnotite. Avg. grade better than 1% V ₂ O ₅ . Thin streaks and bands continue south for 20 ft. Horizon about 43 ft. above base of Salt Wash. Sample 3513 cut.
NC-12	---	NEW - Two ore horizons at 22 ft. and 43 ft. above base of Salt Wash. Lower horizon, 11 ft. outcrop of avg. 0.3 ft. thickness, consists of vanoxite-type with carnotite around and between casts of two trees 6 ft. apart in light-brown, shaly sandstone containing many small clay galls. Estimated grade 2% V ₂ O ₅ . Upper horizon, 20 ft. outcrop with avg. 0.5 ft. thickness, is 20 ft. to south. Vanoxite type with very minor carnotite in cross-bedded, calcareous, light-gray sandstone. Grade 0.75 to 1.5% V ₂ O ₅ .

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, NORTH CARRIZO LOCALITY - contd.

<u>Showing</u>	<u>New Figure</u>	<u>Notes</u>
NC-13	---	NEW - 53-ft outcrop, 11 ft. barren, maximum thickness 4.8 ft. but avg. about 0.6 ft.; occurs about 30 ft. above base of Salt Wash. Best on lensing ends. Middle thickest but very weakly mineralized. Disseminated carnotite at N. end. Generally in light-brown, clay-bearing sandstone containing occasional reed-like vegetal remnants. Estimated grade 1% V ₂ O ₅ .
NC-14	---	NEW - Two avg. 0.3-ft. thick intermittent bands of vanoxite type with weakly disseminated carnotite in hard, calcareous, dark-brown, coarse-grained sandstones separated by light-brown, friable, coarse-grained sandstone containing moderate amounts of disseminated carnotite. One 5-in. log cast with 1 to 2 in. halo of vanoxite type and carnotite. Estimated 1% V ₂ O ₅ . Horizon about 32 ft. above base of Salt Wash.
NC-15	---	NEW - 17-ft. intermittent lens, avg. 0.2 ft. thickness, about 43 ft. above base of Salt Wash. In cross-bedded, lenticular, usually calcareous, light-gray, medium-grained sandstone. Ore follows cross-bedding. Estimated grade better than 1% V ₂ O ₅ .
NC-16	---	NEW - 34-ft. outcrop, avg. thickness 0.4 ft. of pinching bands in flat-bedded, light-gray, friable sandstone with some calcareous cement and occasional clay galls. Horizon about 38 ft. above base of Salt Wash. Est. grade about 1% V ₂ O ₅ . Sample 3010 cut 12 ft. from S. end of lower band. Continues to N. as thin streak for approx. 46 ft.
NC-17	---	NEW - Two pockets of vanoxite type. First is oval (1.8 ft. by 0.8 ft.) tree cast with thin halo with disseminated carnotite in flat-bedded, hard, light-brown, calcareous sandstone. Estimated grade about 1% V ₂ O ₅ . Second is 57 ft. to S. And 5 ft. higher stratigraphically. 5 ft. long by avg. 0.5 ft. thick; lens at one end of lens of cross-bedded, brown, calcareous, sandstone. Estimated grade 1% V ₂ O ₅ .
NC-18	---	NEW - 43-ft. intermittent outcrop of vanoxite type with occasional disseminated carnotite, avg. thickness 0.5 ft. and maximum 1.5 ft., in thin-bedded, friable, silty sandstone at W. end; hard

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, NORTH CARRIZO LOCALITY - contd.

<u>Showing</u>	<u>New Figure</u>	<u>Notes</u>
		calcareous, light-gray sandstone in middle and friable, medium hard sandstone with 1/4-in. clay galls at east end. Est. grade 1% V ₂ O ₅ . Sample 3011 cut 31 ft. E. of E. end.
NC-19	---	NEW - 7-ft. low-grade vanoxite outcrop, avg. thickness 0.4 ft., partly talus-covered in thin-bedded, platy, mostly flat-bedded, friable sandstone.
NC-20	---	NEW - 0.1 to 0.5 ft. vanoxite-type halo around large tree cast exposed for 18 ft. in depth. Carnotite locally abundant. Ore occurrence about 25 ft. above base of Salt Wash. Est. grade 1% to 2%.
NC-21	---	NEW - 60-ft. outcrop of weakly mineralized sandstone with lensing streaks to 2 ft. thick zones. Avg. thickness 0.6 to 0.8 ft.
UMDC Lease No. 3		
Vicinity		
Pit 1	Fig.No.41	NEW
Pit 2	Fig.No.41	NEW
Pit 3	Fig.No.41	NEW
Pit 4	Fig.No.41	NEW
Pit 5	Fig.No.41	NEW
VCA (Rattlesnake)		
No.8 Mine	Fig.No.42	NEW - Small mine operated by Vanadium Corp. of America. Apparent ore trend E. to SE. Ore seams are irregular, lenticular, and undulatory throughout mine.
Rattlesnake Group		
Incline		
Mine	Ariz-cu-29	NEW - Largest individual working of group, 30 ft. below valley alluvium. Ore body elongated about 220 ft. N. 30° E. with 80 ft. width. Bench stoping due to undulating character of ore lenses. Mostly rattlesnake-type ore; i.e. very streaky, spotty, banded, barren, and vanadiferous seams.
	30	
Mines 1,2,3,4		NEW - Exploratory openings which formerly contained mineralized trees. Probably some tabular ore horizon in mines Nos. 3, 4, and Pit B.
and pit B	Ariz-cu-29	
	30	
Pits A,C,D,		NEW - Little remaining mineralization. Mostly remnant of mined-out halos around mineralized trees or thin-bedded, platy, shaly carbonaceous, vanadiferous sandstone with small amounts of
E,F,G,H	Ariz-cu-29	
	30 (except	
	Pit H)	

CARRIZO UPLIFT AREA, SIGI HO CHO DISTRICT, NORTH CARRIZO LOCALITY - contd.

<u>Showing</u>	<u>New Figure</u>	<u>Notes</u>
		associated carnotite.
Mine No.5	Fig.No.44 (Ariz-cu-29)	NEW - Considerably higher stratigraphically than main group
NC-7A	Fig.No.44 (Ariz-cu-29)	NEW
Rattlesnake Group		
E.Pits	Fig.No.45	NEW - Intermittent mineralization, spotty carnotite.
Pit RC-1	Fig.No.46	NEW
RC-2	---	NEW - Cut and 40-ft. adit on spotty vanoxite-type mineralization in carbonaceous material in shale seam and in enclosing sandstone. High- to low-grade small patches.
RC-3	---	NEW - 8 ft. adit on tree remnants in shaly sandstone. No ore in face.
RC-4	---	NEW - Blank pit.
RC-5	Fig.No.46	NEW - Mined out.
RC-6	---	NEW - Pits on apparently mostly mined out low-grade vanadiferous sandstone.
RC-7	Fig.No.47	NEW - Exploratory openings on lenticular, irregular, undulating seams of various horizons.

of the Secretary of the Interior nor can the lease be assigned or sold without his approval.

Physical Conditions

Topography is an important factor in the mining of the SOM-vanadium deposits in these areas. In most cases, the mineralization outcrops on the top or part way up the cliffs of the mesas. Wooden chutes or aerial trams may be used for the transport of mined ore to storage bins or trucks. Wade, Curran and Co. successfully employed a "jig-back" aerial tram for this purpose. Hoisting could be accomplished through raises or outside inclines if economically practical. The rugged terrain hinders the building of roads with easy grades and good surfaces. Traffic at present follows circuitous routes on rough dirt roads, often with steep grades, through sand dunes, across bare rock surfaces, across unbridged washes and along watercourses dotted with quicksand traps. The mud from winter snows halts heavy traffic and the flooding of the washes by summer thundershowers impedes all travel. Under the best conditions, ore trucks make only 1 or 2 miles per hour in the more remote areas and truckers charge \$0.06 per ton-mile for loads of 6 tons on 1½-ton trucks from the districts to Farmington, New Mexico. Most of the unmined outcrops have no access roads at present and any new developments would require many miles of new roads over tortuous country.

Only a small amount of timber is required in this type of mining. Sawed timber may be obtained in Farmington, New Mexico, while suitable small props are available in the form of local vegetation in the higher portions of the area. Live trees can be cut only with the permission of the U. S. Indian Service.

Water for mining operations has to be hauled in tanks or barrels direct to the working site. Limited supplies can be obtained from the local springs or intermittent streams and domestic water may also be obtained at the springs or hauled from Farmington. During the summer season, one gallon of water per day, exclusive of cooking requirements, is required per laborer.

Unskilled labor must be recruited from the local Indians. The Navajo Indian does good work if well directed. An English speaking native "strawboss" and as many English speaking Navajos as possible facilitate operations. At least one Navajo speaking white man is quite desirable.

Mining is best carried out with water-lined jack hammers supported by jack legs. Stoping by side-swiping to the drift

entries is common practice. Trimming is best accomplished with small tram cars or wheelbarrows. The latter are more practical due to the small size and usual irregular floors of most mines.

Geologic Conditions

Because the ore occurs in a roughly horizontal, tabular form, it can be best mined by a modified room-and-pillar method. Only small pillars are usually needed because the rock in the backs of the stopes holds up well even over unsupported distances of 50 to 60 ft. Where the stope backs tend to spall, closer-spaced pillars or occasional stulls may be needed.

Where there is a thickness of overlying sediments, the deposits are usually opened up by drift entries but the shallower deposits may be exploited by open pits. Deposits of intermediate depth may be opened up by means of inclined shafts. All workings are usually driven so that the back will be in solid sandstone and still remain low enough so that the entire thickness of ore may be extracted. Usually only the ore is mined but occasionally in banded ore a whole face has to be broken and later the "muck" is hand sorted. Where very high-grade ore is present, as in deposits of mineralized trees, this high-grade ore may be separated from the mill run ore. Material below the cut-off grade is only occasionally stockpiled. Selective extraction may be employed where the ore or waste will break cleanly from one another. Practically all the ore and host rock can be easily drilled and breaks with a moderate number of holes and slow-burning, medium-strength powder.

ORE RESERVES

Ore reserves have been calculated for the Cove, Kinusta, Toh Acon, and Sigi Ho Cho Districts. These reserves are shown in Table A, the tonnages being classified by degree of certainty and by grade for each locality and/or district. Table B gives the corresponding percents V₂₀₅ for the tonnage figures shown in Table A.

Methods of Calculation

The ore reserves are divided into three classes based on their degree of certainty and three grades based on the contained percentage SOQ.

SUMMARY TABULATION OF TONNAGE ESTIMATES BASED ON SOQ GRADES
Cove, Kinusta, Toh Acon, and Sigi Ho Cho Districts
Chuska Mountains and Carrizo Uplift Areas, Navajo Indian Reservation

(All figures in short tons)

Location	Positive Ore			Indicated Ore			Inferred Ore			Totals
	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	
Sigi Ho Cho Dist.										
Sigi Ho Cho	---	---	---	---	---	---	---	---	67,250	67,250
Mesa										
Sunnyside Mesa	---	110	---	---	240	---	---	---	---	350
Eurida Mesa	---	800	---	80	90	410	---	---	---	1,380
Saytah Canyon	---	---	30	---	---	270	---	12,410	4,800	17,510
Martin Mesa & N. Carrizo	170	510	---	1,490	1,950	50	7,860	80,390	---	92,420
Sigi Ho Cho Dist.										
Totals	170	1,420	30	1,570	2,280	730	7,860	92,800	72,050	178,910
Cove Dist.	---	---	---	---	---	---	39,180	14,400	---	53,620
Kinusta Dist.	---	---	---	---	---	---	---	---	146,960	146,960
Toh Acon Dist.	---	---	---	---	---	---	---	---	20,460	20,460
TOTAL Grade 1	170			1,570			47,040			48,780
Grade 2		1,420			2,280			107,240		110,940
Grade 3			30			730			239,470	240,230
Total Pos.	- 1,620			Total Ind. - 4,580			Total Inf. - 393,750			

Wtd. Avg. SOQ, all grades - 0.091

GRAND TOTAL, all types and grades

399,950

Table B

following page 33

SUMMARY TABULATION OF WEIGHTED %V₂O₅ GRADES CORRESPONDING TO TONNAGES SHOWN IN TABLE A
Cove, Kinusta, Toh Acon, and Sigi Ho Cho Districts
Chuska Mountains and Carrizo Uplift Areas, Navajo Indian Reservation

Location	Positive Ore			Indicated Ore			Inferred Ore			Wtd. Avg.
	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	
Sigi Ho Cho Dist.										
Sigi Ho Cho Mesa	---	---	---	---	---	---	---	---	1.528	1.528
Sunnyside Mesa	---	2.261	---	---	2.022	---	---	---	---	2.097
Eurida Mesa	---	2.988	---	3.752	4.124	1.693	---	---	---	2.722
Saytah Canyon	---	---	1.313	---	---	1.314	---	1.503	1.361	1.461
Martin Mesa & N. Carrizo	2.716	1.210	---	1.883	1.208	1.460	1.626	1.317	---	1.352
Sigi Ho Cho Dist. Weighted Average	2.716	2.293	1.313	1.978	1.409	1.537	1.626	1.342	1.517	1.441
Cove Dist.	---	---	---	---	---	---	2.172	1.854	---	2.086
Kinusta Dist.	---	---	---	---	---	---	---	---	0.817	0.817
Toh Acon Dist.	---	---	---	---	---	---	---	---	1.628	1.628
WTD. AVG. Grade 1	2.716			1.978			2.081			2.080
Grade 2		2.293			1.409			1.411		2.422
Grade 3			1.313			1.537			1.097	1.098
Wtd. Avg. Pos. -	2.319			Wtd. Avg. Ind. - 1.624			Wtd. Avg. Inf. - 1.300			

WTD. AVG., all types and grades, 399,950 tons at 1.308

Ore reserves are classified as positive ore when only a small amount of inference is needed to delimit their spatial outline and when their recovery can be assured with a high degree of certainty. The outline of the individual positive ore block is, in a large measure, controlled by exposures and limited inward from the exposures to reasonably projected distances, i.e., 10 to 20 ft. depending on the number, length and character of the exposures.

Ore reserves are classified as indicated ore when a moderate amount of inference is required to delimit its spatial outline and when there is only a moderate degree of certainty of its recovery. The dimensions of the individual indicated blocks are defined by projections from ore exposures and/or positive ore blocks for distances governed by measurable and inferable factors. The measurable factors are the same as those used for positive ore blocks; the inferable factors are conservative geologic assumptions based on field examination.

Ore reserves are classified as inferred ore when a large amount of inference is required to delimit its spatial outline and when there is a relatively low degree of certainty of its recovery. The dimensions of the individual inferred ore blocks are defined by geologic concepts of the continuity and extent of the mineralization as deduced from the ore exposures. Measurable factors have a minor and limited control.

The inferred blocks, as compared to positive and indicated blocks, can seldom be delimited to enclosed volumes estimated to be equally mineralized throughout. There is insufficient knowledge to permit further limitation of the blocks to more favorable portions. In order to express the percentage of inferred blocks that may reasonably be expected to be mineralized, mineralization factors are deduced and applied to the volumes. These mineralization factors are deduced by using essentially the same observations as are used for the delimitation of the inferred blocks. In the present report, the mineralization factor is a rough estimate based on either the ratio of linear mineralized outcrop to the total outcrop or the ratio of mineralized area to the total inferred block area.

The ore reserves are also divided into three grades depending on the SOQ content. Grade 1 is ore containing 0.15% or more SOQ; Grade 2, 0.08% to 0.15% SOQ; and Grade 3, 0.005% to 0.08% SOQ.

The calculation tables and sheets and the summary tables are in general self-explanatory. These tables and sheets are enclosed in a separate folder with a cross-reference index. Positive ore blocks are numbered in sequence for each mine or outcrop with Arabic numerals, and are shown on the maps and

figures in red. Indicated ore blocks are numbered in sequence for each mine or outcrop with Roman numerals and are colored blue on the maps and figures. Inferred ore blocks are lettered in sequence by locality or district with capital letters and are outlined in yellow on the maps or figures.

The areas of the ore blocks were measured by planimeter or by scaling. The average widths (thicknesses) of the blocks were determined from field observations, lengths of channel sample cuts and from geologic projections. The volume of the block is the product of the area times the average width. The volume times the mineralization factor and divided by the tonnage factor, 14 cu. ft. per ton, gives the tons of ore in the block. The latter figure is calculated to the nearest ton and then rounded to the nearest 10 tons. Where several small blocks occur in a single mine or outcrop and where the same assay data are applied to all the small blocks, their tonnages are summed to produce one total block for that mine or outcrop.

The sample and assay data applicable to a block is weighted by sample widths to give the grade of the block. The pounds of contained products were calculated to the nearest pound from these weighted grades. In the summary tables, the pounds of contained products are converted to tons and the electroscopic and chemical tons SOQ are averaged to give a final SOQ tonnage figure.

All the newer assays and some of the older assays which were pertinent to the needs of the present report are shown on the maps and figures in the following order: Field No.- Sample width (ft.) - Chemical %SOQ - Chemical %V₂O₅. The Office No. is placed below the Field No. and the Electroscopic %SOQ is placed under the Chemical %SOQ. Letter abbreviations following the assays indicate the following sources of analysis: B indicates the Burlingame Laboratory in Denver, Colorado; T indicates the Tonawanda Laboratory at Tonawanda, New York; R indicates the U. S. Vanadium Corp. Laboratory at Rifle, Colo; E indicates the electrocope analysis in the Union Mines Development Corp. office in Grand Junction; and G, the Geiger-Mueller counter analysis on the Michele in the same Grand Junction office.

Individual Deposits

CHUSKA MOUNTAINS AREA

Cove District

Cove Mesa Locality (see Ariz-cm-1): The ore exposures on the mesa did not warrant positive or indicated ore blocks.

Outcrops S-44 and S-48 were slightly developed but no lateral extent of mineralization normal to the outcrop could be proven. Four blocks of inferred ore, A, B, C, and D, have been calculated. These inferred blocks include the only intensely mineralized portions of the exposed rim of the mesa and what is believed to be their probable projection. Several outcrops within the delimited areas were excluded in the calculations because they are too far removed, stratigraphically, from the ore zone common to the majority of the outcrops. The certainty of this tonnage can only be determined by exploration.

CARRIZO UPLIFT AREA

Kinusta District

Kinusta Mesa Locality (see Ariz-cu-25): The ore exposures on this mesa did not warrant positive or indicated ore blocks. Three blocks of inferred ore, A, B, and C, have been calculated on the same basis as on Cove Mesa. Isolated and weakly mineralized outcrops were not included. Samples 223, 224, 225, and 226 were not used in calculating Block B because their electroscopic SOQ values were lacking. The mineralization in these blocks is lower grade, weaker and more dispersed than that on Cove Mesa.

Toh Acon District

Toh Acon Mesa Locality: (see Ariz-cu-15): No positive or indicated ore blocks were warranted. One block of inferred ore, A, has been calculated on the most intensively mineralized part as deduced from the outcrop exposures. The other ore occurrences are too scattered to control ore blocks.

Sigi Ho Cho District

Sigi Ho Cho Mesa Locality (see Ariz-cu-27): No positive or indicated ore blocks were warranted. Three inferred ore blocks, A, B, and C, have been calculated. The largest block, A, included 11 dispersed and moderately mineralized outcrops. The other 2 small blocks would scarcely warrant calculation except that the outcrops governing them do show better mineralization than others on this mesa.

Sunnyside Mesa Locality: The Sunnyside mine (Fig. No. 25) was believed by the operators to be stripped of all economic ore at the time they ceased mining in the fall of 1943. However, a small tonnage of positive ore still remains in the pillars and a larger tonnage of indicated ore lies around the periphery of the workings. The other ore occurrences are too weak and spotty to warrant the calculation of an inferred ore block.

Eurida Mesa Locality: The Eurida mine (Fig. No. 26) has several adits exposing good mineralization but the geological observations did not indicate any possible projection of the ore beyond the boundaries of the positive block.

The Eurida Mine, East Workings (Fig. No. 27) have 3 short adits exposing mineralization but the continuity of the ore between them cannot be assumed. Small blocks of indicated ore were calculated about the two adits which show the most consistent mineralization.

The Eurida No. 2 Claim (Fig. No. 29) has intermittently mineralized outcrops unexplored in depth. Four small indicated blocks have been calculated on the more intensely mineralized outcrops.

Because of the widely scattered, weakly mineralized outcrops on Eurida Mesa, no inferred ore block was warranted.

Saytah Canyon Locality (see Fig. 35): The CBW-MC Mine (Fig. No. 32) was considered to have been stripped of economic ore by the operators at the time they ceased mining in February, 1944. However, a small tonnage of positive ore remains in pillars and a larger tonnage of indicated ore lies to the east and west of the workings.

Two blocks of inferred ore, C and D, have been calculated in Saytah Canyon. None of the individual outcrops, other than the CBW-MC mine, showed mineralization sufficient to warrant positive or indicated blocks. The inferred blocks include the most intensely mineralized portions of the exposed rim and their projections are based on geologic deductions.

Carrizo Mountains Locality: The mineralization in this locality is relatively localized and comparatively weak. The obscured size and shape of the Salt Wash block limits any ore projections. Thus no ore was calculated in this locality.

Martin Mesa and North Carrizo Localities (see Ariz-cu-24): The Hogan Mine (Fig. No. 36) has one block of indicated ore around the only adit that shows consistent mineralization.

The Martin Mine (Fig. No. 39) has 9 small pillars of positive ore and 4 indicated blocks where the mineralization appeared to be comparatively uniform and continuous.

The Saytah Mine (Fig. No. 40) has 3 small indicated ore blocks around the mineralization localized in halos by tree pockets.

The VCA No. 8 Mine (Fig. No. 42) has 5 positive ore blocks occurring in pillars in the mine. Four indicated blocks were calculated around the workings where the mineralization was continuous.

Mine No. 5 (Fig. No. 44) has 2 small blocks of indicated ore around tree mineralization.

Rattlesnake Group (Ariz-cu-30) has all classes of blocks around the various workings which occur in the same general ore horizon. The 10 small blocks of positive ore occur in the form of mine pillars. The 10 blocks of indicated ore are projections of the mineralization from the workings or between several closely adjacent workings. The areal extent of the latter blocks is considered conservative and would probably be greatly increased if drill hole data were available.

A large inferred block has been calculated to include the area of all the workings in this group. The volume of this block is the product of the average width of all the positive and indicated blocks times the net inferred area, i.e., the whole area minus the barren area and the explored areas.

The Mine RC-5 (Fig. No. 46) has 2 small pillars of positive ore and 2 blocks of indicated ore on the north and south sides of the workings.

The Mine RC-7 (Fig. No. 47), the mineralization occurs in intermittent and lenticular ore seams and thus only 5 small indicated ore blocks in the more intensely mineralized zones can be calculated.

A very large inferred ore block, B, has been calculated in the Martin Mesa and North Carrizo Localities. The area included in the block includes all the workings and mineralized outcrops except for those covered by inferred block A. The mineralization is weak, spotty, and dispersed, especially to the west of Lower Saytah Wash but the large number of ore occurrences found justify its calculation.

EXPLORATION

Methods

The two methods of exploration of this type of deposit that are considered to be most feasible are underground drifting and surface diamond drilling. The first method is better

for following ore or ore horizons in deposits partially mined or developed, or in exploring from outcrops where the overburden is extremely thick or contains formations hazardous to diamond drilling. In the districts covered in this report, the cover rock over the ore horizons is usually relatively thin and easily drilled. Thus diamond drilling, with core and sludge recoveries, is well suited for the exploration of the larger ore blocks. Exploratory drilling should be followed by development drilling to delineate the mineralized areas.

On the Cove, Kinusta, Sigi Ho Cho, and Saytah Canyon Mesas, any kind of exploration would be hampered by the lack of roads or other access to the top of those mesas. In the Toh Acon and Martin Mesas and North Carrizo Localities, some roads to the top of the mesas are already present but others would be required for any extensive drilling program. The transportation of supplies, equipment, and water would present difficult problems.

A summary of the estimated required exploration is given in the appendix and details are given below.

Exploration of Individual Deposits or Areas

CHUSKA MOUNTAINS AREA

Cove District

Cove Mesa Locality: Diamond drilling is recommended for the inferred blocks in this locality. The preliminary drilling should be at widely spaced centers of 300 ft. and be followed by secondary drilling with closer-spaced centers where mineralization is disclosed. Using a probability factor similar to the mineralization factor, a total of 336 holes would be required with an average depth of 40 ft. Some underground development on the exposed outcrops would furnish additional information for the secondary drilling. The northeast corner of Cove Mesa is the most suitable location for an access road to the top of the mesa. There is no road or means of transport of equipment to the top at present.

CARRIZO UPLIFT AREA

Kinusta District

Kinusta Mesa Locality: The exploration pattern on this mesa would follow a similar procedure as that on Cove Mesa. In like manner, 449 holes with an average depth of 40.5 ft. would be required. The most suitable access road would be

across the narrow land bridge connecting Toh Acon and Kinusta Mesas. The former mesa has a road along its top at present.

Toh Acon District

Toh Acon Mesa Locality: The same exploration procedure would be used on this mesa as on Kinusta and Cove Mesas. About 142 holes having an average depth of 30 ft. would be required. Access is relatively easy in this locality as a road runs along the center of the inferred block and the surrounding terrain is comparatively flat.

Sigi Ho Cho District

Sigi Ho Cho Mesa Locality: For Block A on this mesa, diamond drilling of the westernmost two-thirds at 300 ft. centers and a line of holes along the east rim to the north is recommended. The northern portion of the block is covered by several hundred feet of sediments and is thus impractical for drilling. In this northern area around outcrops 1, 2, and 3, about 1000 ft. of 4 by 6 ft. drifting is recommended. Blocks B and C could be easily explored by a few carefully placed drill holes. A total of about 188 holes would be required. Transportation of supplies would be extremely difficult and would only be feasible by packmules from the poor road in Walker Creek.

Saytah Canyon Localities: A drilling program similar to that outlined for Cove and Kinusta Mesas is recommended for the inferred ore blocks C and D. However, since the cover in some portions is comparatively great, drifting may be more desirable in the more extensively mineralized areas. About 172 holes with an average depth of 115 ft. would be required. An access road would have to be built from the existing road in the canyon.

Martin Mesa and North Carrizo Localities: In the Rattlesnake group, 35 diamond drill holes with an average depth of 20 ft. would suffice to explore the inferred block A. A study of the ore body trends would aid in the location of the proposed holes

In inferred block B, diamond drilling at 500 ft. centers and a series of holes at smaller intervals around the present workings and extensively mineralized outcrops is recommended. About 920 holes with an average depth of 50 ft. would be required to adequately explore this large area. Several spur access roads would be needed for the transportation of equipment and supplies.

John W. Harshbarger

LIST OF LARGE MAPS TO ACCOMPANY REPORT

<u>Ariz-</u>	<u>Title</u>	<u>District</u>	<u>Scale</u>
cu-23	Areal Geology	Sigi Ho Cho (southern portion) Kinusta and Cove	1 in. = 2000 ft.
cu-24	Areal Geology	Sigi Ho Cho (northern portion)	1 in. = 2000 ft.
cu-15	Areal Geology	Toh Acon	1 in. = 2000 ft.
cm-1	Map of Ore Horizons	Cove	1 in. = 500 ft.
cu-25	Kinusta Mesa, Plot E	Kinusta	1 in. = 500 ft.
cu-26	Outcrops 2,14,25,26,27 28	Kinusta	1 in. = 20 ft.
cu-27	UMDC Lease Plots B,C,D	Sigi Ho Cho	1 in. = 500 ft.; 1 in. = 100 ft.
cu-28	Eurida Mesa	Sigi Ho Cho	1 in. = 500 ft.
cu-29	Rattlesnake Group	Sigi Ho Cho	1 in. = 100 ft.
cu-20	Rattlesnake Group Mines 1,2,3, and 4 Pits A,B,C,D,E,F,G	Sigi Ho Cho	1 in. = 40 ft.
cu-cm-5	General map of the area		

APPENDIX NO. 1

Teec Nos Pas Deposits

The Vanadium Corporation of America holds a leased plot near the Teec Nos Pas trading post on the north side of the Carrizo Mountains. This small mineralized locality does not appear on any of the areal maps but the deposits were visited by Party No. 3 in the spring of 1944 and a brief description of the locality and deposits is given here.

The locality covers a small outlier of the Salt Wash member of the Morrison formation and is located 14,731 ft. S. 32°19' W. from the Teec Nos Pas trading post. The Salt Wash outcrop is about 2000 ft. long in a north to south direction and about 1000 to 1500 ft. wide. The locality is accessible by a fair dirt road which leaves the Teec Nos Pas-Mexican Water road about 2 miles north of the trading post. The entire area was held under a U. S. Indian Service lease by the Vanadium Corp. of America, who was working the property at the time of the investigation.

The mineralization consists of 4 main outcrops having a total exposed length of 206 ft. of 1% to 2% V₂O₅ ore. Carnotite is present in small amounts in all the outcrops. The following notes describe the outcrops which are shown on the sketch map, Figure No. 48.

TNP-1: The largest outcrop of the group, 60 ft. long but partly covered with talus. Average thickness is about 2 ft. Exposed for depth of 20 ft. Ore occurs in steeply cross-bedded, light-brown, friable sandstone. 40 ft. to south there are 2 spots of similar ore, totalling 20 ft. in length with an average thickness of 1 ft. Estimated grade is 1% to 1.5% V₂O₅.

TNP-2: A 48-ft. outcrop with average thickness of 0.5 ft. and maximum thickness of 1.5 ft. Estimated grade about 1% V₂O₅.

TNP-3: a 12-ft. outcrop with an average thickness of 1 ft. Estimated grade about 2% to 3% V₂O₅. Working in development stage.

TNP-4: a 61-ft. outcrop on thin streaks having an average thickness of 0.2 to 0.3 ft. but with local swells to 0.8 ft. Estimated grade is about 1% V₂O₅.

About 20 ft. to the south there is a 5-ft. long outcrop of average 1.5-ft. width and estimated grade of 2% V₂O₅.

APPENDIX 2
Cross Reference to Navajo Indian Reservation Samples Previously Reported
Chuska Mountains and Western Carrizo Uplift Areas

Field	Number	Office	Location	Outcrop	Width feet	%SOQ			%V205		Assays Used		Old Map	New Map		
						B	T	E	B	T	SOQ	V205				
						Cove Mesa District										
1	28		Cove Mesa	S-4	2.5	N11	0.05	0.065	1.60		T E	B	Ariz-cm-2			
1-A	29		Cove Mesa	S-4	1.1	None	0.05	0.04	1.55		T E	B	Ariz-cm-2			
2	30		Cove Mesa	S-3	1.8	0.07	0.12	0.22	1.30		T E	B	Ariz-cm-2			
3	31		Cove Mesa	S-1	1.0	0.53	0.60	0.75	3.60		T E	B	Ariz-cm-2			
3-A	32		Cove Mesa	S-1	0.2	0.45	0.35	0.36	4.35		T E	B	Ariz-cm-2			
4	33		Cove Mesa	S-1	3.0	0.61	0.75	0.82	3.20		T E	B	Ariz-cm-2			
5	34		Cove Mesa	S-13	1.3	0.07	0.35	0.38	1.15		T E	B	Ariz-cm-2			
6	35		Cove Mesa	S-13	1.0	0.07	0.27	0.25	1.65		T E	B	Ariz-cm-2			
7	36		Cove Mesa	Grab		Not										
						Assayed	0.04	0.04	Qual. Tr.		Location Unknown					
8	37		Cove Mesa	S-15	2.5	0.23	0.27	0.235	1.70		Different Horizon		Ariz-cm-2			
9	38		Cove Mesa	S-17	0.77	0.23	0.13	0.145	1.75		T E	B	Ariz-cm-2	Fig. No. 9		
10	39		Cove Mesa	S-18	4.2	0.53	0.47	0.59	2.40		T E	B	Ariz-cm-3			
11	40		Cove Mesa	S-18	1.9	0.08	0.29	0.40	2.95		T E	B	Ariz-cm-3			
14	41		Cove Mesa	S-25	0.5	None	0.06	0.11	2.20		T E	B	Ariz-cm-3			
15	42		Cove Mesa	S-24	0.8	None	0.03	0.02	0.60		T E	B	Not Shown			
12	43		Cove Mesa	S-18	0.4	0.83	0.87	0.72	4.50		Not Representative		Ariz-cm-3			
13	44		Cove Mesa	S-20	1.0	N11	0.07	0.11	1.85		T E	B	Ariz-cm-3			
17	45		Cove Mesa	S-27	0.9	0.07	0.15	0.20	2.40		T E	B	No Detail			
18	46		Cove Mesa	S-27	1.1	0.15	0.29	0.38	2.70		T E	B	No Detail	Fig. No. 8		
19	47		Cove Mesa	S-28	1.0	0.07	0.03	0.05	1.15		T E	B	Ariz-cm-3	Fig. No. 7		

Note: B-Burlingame Assay T-Tonowanda Assay E-Electroscopic Assay

Appendix 2 cont.

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Number		Location	Outcrop	Width feet	%SOQ			%V ₂ O ₅		Assays Used		Old Map	New Map
Field	Office				B	T	E	B	T	SOQ	V ₂ O ₅		
Sigi Ho Cho District													
1	2-17,48	Eurida Mesa	Eurida Mine	1.2	0.20	0.09	0.22	4.55	5.06	T E	T	Page 68	Fig. No. 26
2	2-18,49	Eurida Mesa	Eurida Mine	2.0	0.40	0.21	0.29	3.65	4.08	T E	T	Page 68	
3	2-19,50	Eurida Mesa	Eurida Mine	0.7	0.16	0.02	0.08	1.55	1.78	T E	T	Page 68	Fig. No. 26
4	2-20,51	Eurida Mesa	Eurida Mine	1.0	0.32	0.02	0.06	1.75	1.98	T E	T	Page 68	Fig. No. 26
1	2-21,52	Eurida Mesa	Eurida E. working	2.2	0.28	0.38	0.34	2.75	3.03	T E	T	Page 81	Fig. No. 27
2	2-22,53	Eurida Mesa	Eurida E. working	1.9	0.16	0.11	0.125	4.75	5.07	T E	T	Page 82	Fig. No. 27
1	2-23,54	Eurida Mesa	Eurida Claim VCA	1.0	0.08	0.02	0.03	0.55	0.58	No ore calculated		Page 83	
2	2-24,55	Eurida Mesa	Eurida Claim VCA	2.1	0.00	0.01	0.025	0.65	0.99	No ore calculated		Page 84	
1	2-25,56	Eurida Mesa	Eurida No. 2 Claim	1.5	0.00	0.01	0.02	1.20	1.33	T E	T	Page 86	Fig. No. 29
1	2-26,57	Eurida Mesa	39	2.0	0.40	0.025	0.08	1.55	1.72	No ore calculated		Page 88	
W-15	58	Martin Mesa	M-3	2.9		0.02	0.115		0.60	T E	T	No detail	Fig. No. 37
W-14	59	Martin Mesa	M-10	1.8		0.05	0.115		0.49	T E	T	No detail	
W-13	60	Martin Mesa	M-9	1.9		0.02	0.06		0.75	T E	T	No detail	
W-12	61	Martin Mesa	M-8	1.1		0.02	0.05		0.73	T E	T	No detail	
W-11	62	Saytah Canyon	S-4	3.2		0.015	0.06		1.60	T E	T	No detail	
W-8	63	Saytah Canyon	CB&W-12	0.5		0.01	0.06		0.64	T E	T	No detail	
W-7	64	Saytah Canyon	CB&W-11	1.3		0.01	0.07		0.55	T E	T	No detail	
W-6	65	Saytah Canyon	CB&W-16	3.3		0.015	0.07		1.23	T E	T	No detail	
S-9	66	Martin Mesa	M-19	1.0		0.02	0.03		0.45	T E	T	No detail	
S-8	67	Martin Mesa	M-11	0.5		0.05	0.055		1.19	T E	T	No detail	
S-7	68	Martin Mesa	M-9	2.3		0.14	0.27		2.28	T E	T	No detail	
S-6	69	Martin Mesa	M-9	1.3		0.035	0.06		0.54	T E	T	No detail	
S-5	70	Martin Mesa	M-8	0.8		0.01	0.04		1.72	T E	T	No detail	
S-4	71	Martin Mesa	M-1	1.4		0.28	0.19		1.10	T E	T	No detail	
S-3	72	Martin Mesa	M-1	1.6		0.05	0.035		1.82	T E	T	No detail	
S-2	73	Saytah Canyon	T-1	2.7		0.01	0.01		1.16	T E	T	No detail	
S-1	74	Saytah Canyon	CB&W-19	1.1		0.015	0.01		1.99	T E	T	No detail	

Appendix 2 cont.
Sigi Ho Cho District cont.

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Number		Location	Outcrop	Width Feet	%SOQ			%V ₂ O ₅		Assays Used		Old Map	New Map
Field	Office				B	T	E	B	T	SOQ	V ₂ O ₅		
P-27	75	Martin Mesa	M-20	1.4		0.02	0.01		0.75	T E	T	No detail	
P-26	76	Martin Mesa	M-20	1.2		0.015	0.01		0.35	T E	T	No detail	
P-25	77	Martin Mesa	M-15	0.2		0.02	0.01		0.69	T E	T	No detail	
P-24	78	Martin Mesa	M-5	2.0		0.015	0.01		0.44	T E	T	No detail	
P-23	79	Martin Mesa	M-7	0.9		0.03	0.045		1.49	T E	T	No detail	
P-22	80	S. Saytah Can.	CB&W-19	0.5		0.02	0.035		0.27	T E	T	No detail	
P-21	81	S. Saytah Can.	S-3	2.3		0.01	0.01		1.21	T E	T	Page 13	Fig. No. 34
P-20	82	S. Saytah Can.	CB&W-15	0.7		0.02	0.01		2.09	Replaced by Sample No. 3490		No detail	
P-19	83	S. Saytah Can.	CB&W-13	0.6		0.02	0.01		2.74	T E	T	No detail	
P-18	84	S. Saytah Can.	S-1	1.0		0.24	0.17		1.19	Replaced by Sample No. 3489		No detail	
P-17	85	S. Saytah Can.	CB&W-17	0.9		0.16	0.17		2.61	T E	T	No detail	
E-22	86	Martin Mesa	M-18	0.7		0.02	0.01		0.65	T E	T	No detail	
E-21	87	Martin Mesa	M-21	0.6		0.015	0.01		0.21	T E	T	No detail	
E-20	88	Martin Mesa	M-12	0.7		0.12	0.12		3.44	No ore calculated		No detail	
E-19	89	Martin Mesa	M-6	0.8		0.05	0.02		0.95	T E	T	No detail	
E-18	90	Martin Mesa	M-5	4.2		0.025	0.03		0.83	T E	T	No detail	
E-17	91	Martin Mesa	M-2	0.3		0.02	0.01		0.72	T E	T	No detail	
E-16	92	Saytah Canyon	T-3	0.5		0.02	0.01		0.69	No ore calculated		No detail	
E-15	93	Saytah Canyon	T-2	0.5		0.015	0.01		0.25	No ore calculated		No detail	
E-12	94	S. Saytah Can.	CB&W-14	1.2		0.015	0.07		0.53	T E	T	No detail	
E-11	95	S. Saytah Can.	CB&W-14	1.0		0.01	0.045		1.18	T E	T	No detail	
E-10	96	S. Saytah Can.	S-1	1.1		0.07	0.095		2.56	Replaced by Sample No. 3489		No detail	
E-9	97	S. Saytah Can.	CB&W-18	1.0		0.13	0.16		3.47	T E	T	No detail	
E-13	98	S. Saytah Can.	CB&W-10	0.8		0.015	0.12		4.52	No ore calculated		No detail	
E-14	99	S. Saytah Can.	S-10	1.2		0.015	0.10		2.30	T E	T	No detail	
W-9	100	S. Saytah Can.	S-2	1.8		0.025	0.02		0.83	T E	T	No detail	
W-10	101	S. Saytah Can.	S-3	2.8		0.005	0.02		0.81	T E	T	No detail	

Appendix 2 cont.

iv

Number		Location	Outcrop	Width feet	%SOQ			%V ₂ O ₅		Assays Used		Old Map	New Map
Field	Office				B	T	E	B	T	SOQ	V ₂ O ₅		
Kinusta Mesa District													
1-K-1	180	Kinusta Mesa	K-1	3.4	0.16	0.02	0.01	0.85		T E	B	Page 2	
2-K-1	181	Kinusta Mesa	K-1	1.2	0.08	0.015	0.01	0.50		T E	B	Page 2	
3-K-1	182	Kinusta Mesa	K-1	1.9	0.08	0.03	0.01	0.58		T E	B	Page 2	
4-K-1	183	Kinusta Mesa	K-1	4.1	0.08	0.04	0.01	0.47		T E	B	Page 2	
5-K-1	184	Kinusta Mesa	K-1	0.9	0.04	0.02	0.06	0.40		T E	B	Page 2	
1-K-17	185	Kinusta Mesa	K-17	4.5	0.00	0.025	0.015	0.15		T E	B	Page 9	
2-K-17	186	Kinusta Mesa	K-17	1.2	0.00	0.03	0.025	0.45		T E	B	Page 9	
1-K-25	187	Kinusta Mesa	K-25	0.9	0.20	0.02	0.01	0.50		T E	B	No detail	Ariz-cu-26
2-K-25	188	Kinusta Mesa	K-25	2.0	0.16	0.065	0.015	0.80		T E	B	No detail	Ariz-cu-26
1-K-26	189	Kinusta Mesa	K-26	4.8	0.28	0.065	0.01	0.80		T E	B	No detail	Ariz-cu-26
2-K-26	190	Kinusta Mesa	K-26	3.3	0.00	0.04	0.01	0.20		T E	B	No detail	Ariz-cu-26
3-K-26	191	Kinusta Mesa	K-26	1.4	0.08	0.04	0.07	1.15		T E	B	No detail	Ariz-cu-26
1-K-27	192	Kinusta Mesa	K-27	1.9	0.60	0.38	0.27	2.10		T E	B	Page 12	Ariz-cu-26
2-K-27	193	Kinusta Mesa	K-27	3.7	0.00	0.035	0.01	0.75		T E	B	Page 12	Ariz-cu-26
3-K-27	194	Kinusta Mesa	K-27	3.4	0.12	0.025	0.045	1.05		T E	B	Page 12	Ariz-cu-26
4-K-27	195	Kinusta Mesa	K-27	2.7	0.00	0.030	0.075	1.25		T E	B	Page 12	Ariz-cu-26
5-K-27	196	Kinusta Mesa	K-27	1.2	0.12	0.15	0.205	1.55		T E	B	Page 12	Ariz-cu-26
6-K-27	197	Kinusta Mesa	K-27	3.0	0.08	0.02	0.08	0.35		T E	B	Page 12	Ariz-cu-26
7-K-27	198	Kinusta Mesa	K-27	5.2	0.00	0.025	0.06	0.50		T E	B	Page 12	Ariz-cu-26
1-K-28	199	Kinusta Mesa	K-28	1.2	0.00	0.035	0.075	0.40		T E	B	Page 12	Ariz-cu-26
E-4	200	Kinusta Mesa	K-18	1.0	0.00	0.03	0.09	0.58		T E	B	No detail	
E-3	201	Kinusta Mesa	K-19	0.9	0.16	0.08	0.10	1.00		T E	B	Page 9	
N-2	202	Kinusta Mesa	K-21	1.9	0.16	0.025	0.12	0.95		T E	B	No detail	
N-1	203	Kinusta Mesa	K-24	2.0	0.12	0.03	0.03	1.40		T E	B	Page 10	
E-1	204	Kinusta Mesa	1-K-24	1.1	0.12	0.02	0.06	0.50		T E	B	Page 11	
E-2	205	Kinusta Mesa	2-K-24	3.7	0.08	0.035	0.075	0.70		T E	B	Page 11	
N-3	206	Kinusta Mesa	2-K-6	3.4		0.015	0.125		1.02	T E	T	Page 6	

Appendix 2 cont.

Kinusta Mesa District cont.

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Field	Number	Office	Location	Outcrop	Width feet	%SOQ			%V205		Assays Used		Old Map	New Map
						B	T	E	B	T	SOQ	V205		
1-K-3	207		Kinusta Mesa	K-3	1.7		0.08	0.145		2.16	T E	T	Page 5	
2-K-3	208		Kinusta Mesa	K-3	3.2		0.12	0.24		1.79	T E	T	Page 5	
1-K-4	209		Kinusta Mesa	K-4	1.6		0.05	0.155		1.18	Different Horiz.		Page 5	
1-K-5	210		Kinusta Mesa	K-5	1.5		0.14	0.245		1.24	Different Horiz.		Page 6	
1-K-6	211		Kinusta Mesa	K-6	3.4		0.01	0.09		0.99	T E	T	Page 6	
1-K-13	212		Kinusta Mesa	K-13	1.7		0.01	0.10		0.52	T E	T	No detail	
2-K-16	213		Kinusta Mesa	K-16	Grab		0.015	0.11		0.67	Grab Sample		No detail	
E-5	214		Kinusta Mesa	K-22	0.8		0.015	0.135		1.02	T E	T	No detail	
E-6	215		Kinusta Mesa	400' SW of K-12	0.3		0.015	0.085		0.04	No ore calculated		No detail	
3-K-17	216		Kinusta Mesa	K-17	2.2	0.00	0.025	0.075	0.25		T E	B	Page 9	
N-4	217		Kinusta Mesa	K-10A	1.4		0.01	0.09		2.52	No ore calculated		No detail	
1-K-7	218		Kinusta Mesa	K-7	Grab		0.01	0.05		0.94	Grab sample		Page 7	
1-K-8	219		Kinusta Mesa	K-8	1.8		0.09	0.095		1.75	No ore calculated		Page 8	
2-K-8	220		Kinusta Mesa	K-8	0.6		0.48	0.57		4.22	No ore calculated		Page 8	
1-K-14	221		Kinusta Mesa	K-14	Grab		0.06	0.11		0.75	Grab sample		No detail	
1-K-16	222		Kinusta Mesa	K-16	0.7		0.07	0.125		2.10	T E	T	No detail	
1-K-2	223		Kinusta Mesa	K-2	1.7	0.24	0.025		0.93		No electrocope assay		Page 2,3	Ariz-cu-26
2-K-2	224		Kinusta Mesa	K-2	1.5	0.24	0.06		1.08		No electrocope assay		Page 2,3	Ariz-cu-26
3-K-2	225		Kinusta Mesa	K-2	1.7	0.32	0.02		1.25		No electrocope assay		Page 2,3	Ariz-cu-26
4-K-2	226		Kinusta Mesa	K-2	1.1	0.20	0.06		0.75		No electrocope assay		Page 2,3	Ariz-cu-26
5-K-2	227		Kinusta Mesa	K-2	1.1	0.12	0.025	0.02	1.25		T E	B	Page 2,3	Ariz-cu-26
6-K-2	228		Kinusta Mesa	K-2	2.0	0.24	0.02	0.12	2.00		T E	B	Page 2,3	Ariz-cu-26
7-K-2	229		Kinusta Mesa	K-2	2.6	0.16	0.06	0.095	1.15		T E	B	Page 2,3	Ariz-cu-26

Appendix 2 cont.

Kinusta Mesa District cont.

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Number		Location	Outcrop	Width feet	%SOQ			%V205		Assays Used		Old Map	New Map
Field	Office				B	T	E	B	T	SOQ	V205		
8-K-2	230	Kinusta Mesa	K-2	2.1	0.16	0.03	0.14	0.80		T E	B	Page 2,3	Ariz-cu-26
9-K-2	231	Kinusta Mesa	K-2	1.0	0.28	0.04	0.09	0.80		T E	B	Page 2,3	Ariz-cu-26
10-K-2	232	Kinusta Mesa	K-2	2.3	0.88	0.13	0.11	1.72		T E	B	Page 2,3	Ariz-cu-26
11-K-2	233	Kinusta Mesa	K-2	3.1	0.96	0.08	0.025	1.65		T E	B	Page 2,3	Ariz-cu-26
12-K-2	234	Kinusta Mesa	K-2	8.0	0.22	0.11	0.235	1.90		T E	B	Page 2,3	Ariz-cu-26
13-K-2	235	Kinusta Mesa	K-2	3.6	0.20	0.035	0.07	0.97		T E	B	Page 2,3	Ariz-cu-26
14-K-2	236	Kinusta Mesa	K-2	3.7	0.16	0.015	0.105	0.35		T E	B	Page 2,3	Ariz-cu-26
15-K-2	237	Kinusta Mesa	K-2	2.5	0.20	0.02	0.03	0.53		T E	B	Page 2,3	Ariz-cu-26
16-K-2	238	Kinusta Mesa	K-2	7.7	0.40	0.03	0.075	0.98		T E	B	Page 2,3	Ariz-cu-26
17-K-2	239	Kinusta Mesa	K-2	4.2	0.12	0.03	0.08	0.72		T E	B	Page 2,3	Ariz-cu-26

Sigi Ho Cho District

1-Show-1	240	Friday Mesa	26A	1.5	0.32	0.10	0.165	2.52		No ore calculated		Page 60	
1-Show-2	241	Friday Mesa	26	4.3	0.13	0.13	0.15	2.20		No ore calculated		Page 60	
1-Show-1	242	Sigi Ho Cho Mesa	14	2.2	0.12	0.04	0.095	2.62		T E	B	Page 44	
2-Show-1	243	Sigi Ho Cho Mesa	14	1.2	0.12	0.02	0.11	2.18		T E	B	Page 44	
1-Show-2	244	Sigi Ho Cho Mesa	15	2.0	0.20	0.02	0.095	2.15		T E	B	Page 44	
2-Show-2	245	Sigi Ho Cho Mesa	15	6.0	0.32	0.03	0.075	2.48		T E	B	Page 44	
1-Show-3	246	Sigi Ho Cho Mesa	17	0.8	0.25	0.03	0.095	1.85		No ore calculated		Page 45	
1-Show-5	247	Sigi Ho Cho Mesa	24	3.5	0.38	0.15	0.15	1.25		No ore calculated		Page 46	
1-Show-6	248	Sigi Ho Cho Mesa	3	2.7	0.13	0.015	0.09	1.40		T E	B	Page 38	
2-Show-6	249	Sigi Ho Cho Mesa	3	1.5	0.20	0.18	0.14	5.45		T E	B	Page 38	
1-Show-8	250	Sigi Ho Cho Mesa	4	2.0	0.36	0.03	0.095	1.75		T E	B	Page 38	
1-Show-7	251	Sigi Ho Cho Mesa	1	1.0	0.28	0.02	0.085	2.05		T E	B	Page 46	

Appendix 2 cont.
Sigi Ho Cho District cont.

vii

Field	Number	Location	Outcrop	Width Feet	%SOQ			%V2O5		Assays Used		Notes	
	Office				B	T	E	B	T	SOQ	V2O5	Old Map	New Map
1-Show-9	252	Sigi Ho Cho Mesa	9A	3.5	0.24	0.02	0.10	1.15		T E	B	Page 42	
1-Show-10	253	Sigi Ho Cho Mesa	13	5.5	0.36	0.015	0.09	2.10		No ore calculated		Page 43	
1	254	Sunnyside Mesa	Sunnyside Mine	1.5	0.35	0.015	0.09	1.60		T E	B	Page 55	Fig.No.25
1-Show-4	255	Sigi Ho Cho Mesa	18	4.0	0.06	0.020	0.14	1.55		No ore calculated		Page 45	
2	256	Sunnyside Mesa	Sunnyside Mine	3.2	0.25	0.03	0.09	1.85		T E	B	Page 55	Fig.No.25
3	257	Sunnyside Mesa	Sunnyside Mine	2.0	0.16	0.06	0.095	1.20		T E	B	Page 55	Fig.No.25
4	258	Sunnyside Mesa	Sunnyside Mine	1.5	0.16	0.035	0.125	1.75		No ore calculated		Page 55	Fig.No.25
1-Show-11	259	Sigi Ho Cho Mesa	7	5.6	None	0.015	0.11	0.80		T E	B	Page 40	
2-Show-11	260	Sigi Ho Cho Mesa	7	5.0	0.24	0.02	0.115	1.35		T E	B	Page 40	
4-Show-11	261	Sigi Ho Cho Mesa	7	2.6	0.08	0.025	0.105	1.40		T E	B	Page 41	
1-Show-12	262	Sigi Ho Cho Mesa	40	3.1	0.28	0.020	0.145	1.05		T E	B	Page 47	
1-Show-1	263	Altar Mesa	34	1.8	0.24	0.045	0.15	1.45		No ore calculated		Page 65	
1-Show-2	264	Altar Mesa	30	2.0	None	0.015	0.11	0.70		No ore calculated		Page 65	
1-Show-1	265	Sunnyside Mesa	29	0.9	None	0.03	0.13	2.05		No ore calculated		Page 53	
3-Show-1	266	Sigi Ho Cho Mesa	7	3.5	0.48	0.05	0.13	2.00		T E	B	Page 41	

Toh A Con District

1-K-9	374	Toh A Con Mesa	K-9	1.2	0.08	0.015	0.01	0.85		No ore calculated		No detail
2-K-9	375	Toh A Con Mesa	K-9	0.7	0.12	0.065	0.01	1.58		No ore calculated		No detail

Appendix 2 cont.
Toh A Con District cont.

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Field	Number		Location	Outcrop	Width feet	%SOQ			%V ₂₀₅		Assays Used		Old Map	New Map
	Office					B	T	E	B	T	SOQ	V ₂₀₅		
3-K-9	376		Toh A Con Mesa	K-9	3.4	0.12	0.03	0.01	1.35		No ore calculated		No detail	
4-K-9	377		Toh A Con Mesa	K-9	1.2	0.08	0.03	0.01	0.65		No ore calculated		No detail	
E-8	378		Toh A Con Mesa	A-1	0.9		0.015	0.07		3.74	No ore calculated		No detail	
N-5	379		Toh A Con Mesa	A-3	Grab		0.15	0.11		4.57	T E T		No detail	
N-6	380		Toh A Con Mesa	A-2	3.3		0.02	0.09		1.13	T E T		No detail	
P-13	381		Toh A Con Mesa	A-5	1.1		0.01	0.05		0.48	No ore calculated		No detail	
P-14	382		Toh A Con Mesa	A-6	3.6		0.01	0.05		1.17	No ore calculated		No detail	
P-15	383		Toh A Con Mesa	A-4	2.0		0.01	0.07		0.61	No ore calculated		No detail	
P-16	384		Toh A Con Mesa	A-4	Grab		0.02	0.075		1.03	No ore calculated		No detail	
W-3	385		Toh A Con Mesa	A-6	0.7		0.01	0.06		1.01	No ore calculated		No detail	
W-4	386		Toh A Con Mesa	A-6	3.6		0.01	0.05		0.57	No ore calculated		No detail	
W-5	387		Toh A Con Mesa	A-4	3.7		0.01	0.06		0.58	No ore calculated		No detail	
E-7	388		Toh A Con Mesa	A-1	2.2		0.03	0.08		1.31	No ore calculated		No detail	
W-1	389		Toh A Con Mesa	A-5	4.2		0.02	0.015		1.44	No ore calculated		No detail	
W-2	290		Toh A Con Mesa	A-5	2.3		0.015			0.76	No ore calculated		No detail	

Cove Mesa District

11-12-1	413	Cove Mesa	Between 44 & 48	Grab	Not assayed	0.025	no pulp	Qual none		Grab Sample))	No detail Location very indefinite
11-12-2	414	Cove Mesa	Between 44 & 48	Grab	not assayed	0.01	no pulp	Qual none		Grab Sample))	
11-12-3	415	Cove Mesa	Between 44 & 48	Grab	not assayed	insuf. pulp	no pulp	Qual present		Grab Sample))	
11-12-4	416	Cove Mesa	Between 44 & 48	Grab	not assayed	0.02	no pulp	Qual none		Grab Sample))	

Cross Reference to Navajo Indian Reservation Samples Not Previously Reported
Chuska Mountains and Western Carrizo Uplift Areas

Number		Location	Outcrop	Width feet	%SOQ				%V205		Assays Used		New Map
Field	Office				T	R	E	G	T	R	SOQ	V205	
3450	3706	Cove Mesa	S-48	2.5		0.03		nil		1.46	R G	R	Fig.No.3
3451	3702	Cove Mesa	S-44	4.0		0.03		0.01		2.10	R G	R	Fig.No.3
3452	3681	Cove Mesa	S-44	1.5		0.20		0.20		2.32	R G	R	Fig.No.3
3453	3667	Cove Mesa	S-45	0.5		0.34		0.24		2.28	R G	R	Fig.No.4
3454	3632	Cove Mesa	S-40	1.7		0.03		0.01		1.81	R G	R	Fig.No.5
3455	3623	Cove Mesa	S-39	1.8		0.03		nil		1.76	R G	R	Fig.No.5
3456	3708	Cove Mesa	S-38	1.3		0.57		0.52		2.07	R G	R	Ariz-cm-1
3457	3682	Cove Mesa	S-33	1.4		0.39		0.35		3.22	R G	R	Fig.No.6
3458	3651	Cove Mesa	S-31	1.6		0.47		0.44		3.56	R G	R	Fig.No.6
3459	3700	Cove Mesa	S-30	1.5		0.04		nil		1.73	R G	R	Fig.No.4
3460	3703	Cove Mesa	S-28	0.8		0.08		0.06		3.27	R G	R	Fig.No.7
3461	3643	Cove Mesa	S-12	1.1		0.03		nil		1.19	R G	R	Ariz-cm-1
3462	3637	Cove Mesa	S-4	0.9		0.03		0.02		2.00	R G	R	Fig.No.8
3463	3630	Cove Mesa	S-9	1.5		0.16		0.12		2.03	No ore calculated		Fig.No.10
3464	3647	Cove Mesa	S-26	0.7		0.13		0.09		1.95	R G	R	Fig.No.8
3465	3713	Cove Mesa	S-53	0.6		0.03		nil		1.24	R G	R	Fig.No.11
3466	3672	Cove Mesa	S-50	1.6		0.18		0.15		1.84	R G	R	Fig.No.8
3467	3709	Cove Mesa	S-51	1.1		0.23		0.21		2.05	R G	R	Fig.No.11
3468	3710	Cove Mesa	S-58	0.5		0.03		nil		1.19	No ore calculated		Ariz-cm-1
3469	3644	Cove Mesa	S-49	1.8		0.13		0.09		1.75	R G	R	Fig.No.12
3477	3654	Cove Mesa	S-5	1.3		0.02		nil		1.53	R G	R	Fig.No.10
3478	3626	Cove Mesa	S-23	1.3		0.10		0.05		1.51	No ore calculated		Ariz-cm-1
3479	3707	Cove Mesa	S-28-A	0.9		0.32		0.28		1.51	R G	R	Fig.No.7
3480	3666	Cove Mesa	S-42-A	0.9		0.09		0.08		1.38	R G	R	Fig.No.4

Note: T - Tonawanda Assay

R - Rifle Assay

E - Electroscope Assay

G - Michele Geiger-Muller Assay

Appendix 2 cont.

Appendix 2 cont.				x									
Number		Location	Outcrop	Width feet	%SOQ				%V2O5		Assays Used		Notes New Map
Field	Office				T	R	E	G	T	R	SOQ	V2O5	
Kinusta Mesa District													
3470	3688	Kinusta Mesa	K-16	0.75		nil		nil		0.37	R G	R	Ariz-cu-25
3471	3701	Kinusta Mesa	K-17	1.0		0.01		nil		0.79	R G	R	Fig.No.20
3472	3697	Kinusta Mesa	K-17	2.1		nil		nil		0.08	R G	R	Fig.No.20
3473	3646	Kinusta Mesa	K-18	0.9		0.04		0.01		1.09	R G	R	Fig.No.20
3474	3629	Kinusta Mesa	K-23	2.0		0.01		0.05		1.76	R G	R	Fig.No.21
3475	3694	Kinusta Mesa	K-24	0.7		0.03		nil		1.70	R G	R	Fig.No.22
3476	3673	Kinusta Mesa	K-24	2.2		0.03		nil		1.42	R G	R	Fig.No.22
Toh Acon District													
3001	1001	Toh Acon Mesa	A-8	0.7	0.025		0.085		1.15		T E	T	Ariz-cu-15
3002	1002	Toh Acon Mesa	A-9	2.8	0.02		0.095		1.30		T E	T	Ariz-cu-15
3003	1003	Toh Acon Mesa	A-9	0.6	0.025		0.05		2.79		T E	T	Ariz-cu-15
3004	1004	Toh Acon Mesa	A-12	1.3	0.03		0.085		1.28		T E	T	Ariz-cu-15
3005	1199	Toh Acon Mesa	A-14	1.5	0.10		0.115		1.28		No ore calculated		Ariz-cu-15
Sigi Ho Cho District													
3006	1430	N. Carrizo	NC-2	0.8	0.07		0.08		1.66		T E	T	Fig.No.43
3007	1422	N. Carrizo	NC-2	1.6	0.32		0.285		1.80		T E	T	Fig.No.43
3008	1426	N. Carrizo	NC-3	1.8	0.23		0.235		1.16		T E	T	Fig.No.37
3009	1429	N. Carrizo	NC-6	1.1	0.39		0.40		2.35		T E	T	Ariz-cu-24
3010	1424	N. Carrizo	NC-16	0.3	0.24		0.26		2.49		T E	T	Ariz-cu-24
3011	1423	N. Carrizo	NC-18	1.1	0.03		0.045		1.47		T E	T	Ariz-cu-24
3012	1425	N. Carrizo	NC-9	1.4	0.04		0.075		2.37		T E	T	Ariz-cu-24
3013	1421	Carrizo Mts.	CM-1	0.8	0.05		0.12		2.63		No ore calculated		Ariz-cu-24
3014	1427	Mexican Water	MW-2	1.4	0.49		0.49		1.21		No ore calculated		Ariz-cu-18
3015	1428	Mexican Water	MW-4	1.1	0.11		0.18		1.14		No ore calculated		Ariz-cu-18
3481	3653	Sigi Ho Cho Mesa	8-A	1.0		0.02		nil		0.52	R G	R	Ariz-cu-27 Fig.No.24

Appendix 2 cont.

Sigi Ho Cho District cont.

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Number		Location	Outcrop	Width Feet	%SOQ				%V205		Assays Used		Notes New Map
Field	Office				T	R	E	G	T	R	SOQ	V205	
3482	3631	Sigi Ho Cho Mesa	40	0.6		0.04		nil		2.87	R G	R	Ariz-cu-27
3483	3699	Sunnyside Mesa	Sunnyside Mine	1.4		0.42		0.32		4.04	R G	R	Fig.No.25
3484	3675	Sunnyside Mesa	Sunnyside Mine	1.0		0.16		0.11		4.20	R G	R	Fig.No.25
3485	3655	Saytah Canyons	CB&W-MC	1.1		0.08		0.08		2.18	R G	R	Fig.No.32
3486	3664	Saytah Canyons	CB&W-MC	1.1		0.03		nil		1.54	R G	R	Fig.No.32
3487	3693	Saytah Canyons	CB&W-MC	2.1		0.05		nil		1.15	R G	R	Fig.No.32
3488	3692	Saytah Canyons	CB&W-MC	2.5		nil		nil		0.97	R G	R	Fig.No.32
3489	3695	Saytah Canyon	S-1	1.2		1.00		0.62		3.20	R G	R	Fig.No.33
3490	3661	Saytah Canyon	CBW-15	1.1		0.02		nil		1.81	R G	R	Fig.No.33
3491	3668	Eurida Mesa	Eurida Mine	2.0		0.05		nil		1.31	R G	R	Fig.No.26
3492	3658	Eurida Mesa	Eurida Mine	1.7		0.09		0.07		3.39	R G	R	Fig.No.26
3493	3691	Eurida Mesa	Eurida Mine	1.0		0.29		0.19		2.84	R G	R	Fig.No.26
3494	3680	Eurida Mesa	Eurida Mine	1.7		0.02		nil		0.79	No ore calculated		Fig.No.26
3495	3704	Eurida Mesa	E. Workings	0.9		0.08		0.03		5.52	R G	R	Fig.No.27
3496	3674	Eurida Mesa	E. Workings	1.1		0.03		nil		1.70	No ore calculated		Fig.No.27
3497	3636	Eurida Mesa	E. Workings	0.7		0.08		0.06		1.56	R G	R	Fig.No.27
3498	3676	Eurida Mesa	V.C.A. Pits	1.0		0.33		0.34		3.64	No ore calculated		Fig.No.28
3499	3685	Eurida Mesa	Eurida No. 2	2.4		0.02		nil		1.73	R G	R	Fig.No.29
3500	3671	Eurida Mesa	Eurida No. 2	0.5		0.04		0.05		2.37	R G	R	Fig.No.29
3501	3669	Eurida Mesa	Eurida No. 2	3.8		0.03		nil		1.76	No ore calculated		Ariz-cu-28
3502	3689	Eurida Mesa	35	0.7		nil		nil		0.47	No ore calculated		Fig.No.31
3503	3698	Martin Mesa	Saytah Mine	1.3		0.57		0.50		1.35	R G	R	Fig.No.40
3504	3683	Martin Mesa	Martin Mine	1.8		0.14		0.13		1.14	R G	R	Fig.No.39
3505	3687	Martin Mesa	Martin Mine	2.0		0.02		0.02		0.54	R G	R	Fig.No.39
3506	3696	Martin Mesa	Martin Mine	0.7		0.04		0.01		1.51	R G	R	Fig.No.39
3507	3677	Martin Mesa	Martin Mine	1.1		0.26		0.25		1.27	R G	R	Fig.No.39
3508	3690	N. Carrizo	VCA #8 Mine	1.2		0.08		0.06		4.70	R G	R	Fig.No.42
3509	3678	N. Carrizo	VCA #8 Mine	1.6		0.36		0.34		2.80	R G	R	Fig.No.42

Appendix 2 cont.

Sigi Ho Cho District cont.

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Number		Location	Outcrop	Width feet	%SOQ				%V ₂ O ₅		Assays Used		Notes New Map
Field	Office				T	R	E	G	T	R	SOQ	V ₂ O ₅	
3510	3684	N. Carrizo	VCA #8 Mine	1.2		0.04		0.02		1.54	R G	R	Fig.No.42
3511	3679	N. Carrizo	VCA #8 Mine	0.8		0.16		0.13		0.84	R G	R	Fig.No.42
3512	3663	Martin Mesa	N.Martin Mine	0.7		0.10		0.08		2.30	R G	R	Fig.No.38
3513	3670	N. Carrizo	NC 11	0.8		0.26		0.22		1.29	R G	R	Ariz-cu-24
3514	3656	N. Carrizo	Lease #3 Vic- inity Pit #1	1.1		0.02		0.01		1.04	R G	R	Fig.No.41
3515	3657	N. Carrizo	Lease #3 Vi- cinity Pit #5	0.8		nil		0.01		1.48	R G	R	Fig.No.41
3516	3686	N. Carrizo	NC-7A	1.5		0.40		0.36		1.36	R G	R	Ariz-cu-29
3517	3635	Martin Mesa	Hogan Mine	1.5		0.03		nil		1.46	R G	R	Fig.No.36
3518	3641	N. Carrizo	RC-5	0.7		0.18		0.15		1.75	R G	R	Fig.No.46
3519	3648	N. Carrizo	RC-7	0.7		0.29		0.24		2.18	R G	R	Fig.No.47
3520	3642	N. Carrizo	Rattlesnake Mine No. 5	1.3		0.10		0.09		2.03	R G	R	Fig.No.44
3521	3633	N. Carrizo	Rattlesnake Incline Mine	1.6		0.01		0.01		0.76	R G	R	Ariz-cu-30
3522	3645	N. Carrizo	Rattlesnake Incline Mine	1.1		0.26		0.24		3.07	R G	R	Ariz-cu-30
3523	3634	N. Carrizo	Rattlesnake Incline Mine	2.4		0.10		0.11		1.16	R G	R	Ariz-cu-30
3524	3652	N. Carrizo	Rattlesnake Incline Mine	1.9		0.22		0.22		2.28	R G	R	Ariz-cu-30
3525	3622	N. Carrizo	Rattlesnake Mine No. 3	2.0		0.01		0.03		0.67	R G	R	Ariz-cu-30
3526	3628	N. Carrizo	Rattlesnake Mine No. 3	1.3		0.06		0.08		0.91	R G	R	Ariz-cu-30
3527	3650	N. Carrizo	Rattlesnake Mine No. 3	1.1		0.18		0.16		0.99	R G	R	Ariz-cu-30
3528	3662	N. Carrizo	Rattlesnake Mine No. 3	1.3		0.12		0.12		1.46	R G	R	Ariz-cu-30

Appendix 2 cont.

Sigi Ho Cho District cont.

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Number		Location	Outcrop	Width feet	%SOQ				%V ₂ O ₅		Assays Used		Notes New Map
Field	Office				T	R	E	G	T	R	SOQ	V ₂ O ₅	
3529	3712	N. Carrizo	Rattlesnake Mine No. 1	1.1		0.40		0.35		2.10	R G	R	Ariz-cu-30
3530	3705	N. Carrizo	Rattlesnake Mine No. 1	1.0		0.04		0.04		1.81	R G	R	Ariz-cu-30
3531	3638	N. Carrizo	Rattlesnake Pit C	0.5		0.32		0.28		3.36	R G	R	Ariz-cu-30
3532	3627	N. Carrizo	Rattlesnake Pit A	0.9		0.03		0.01		0.96	R G	R	Ariz-cu-30
3533	3711	N. Carrizo	Rattlesnake Pit F	0.8		0.47		0.37		1.36	R G	R	Ariz-cu-30
3534	3665	N. Carrizo	Rattlesnake Mine No. 4	1.0		0.21		0.21		0.99	R G	R	Ariz-cu-30
3535	3625	N. Carrizo	Rattlesnake Mine No. 4	1.1		0.21		0.19		1.49	R G	R	Ariz-cu-30
3536	3640	N. Carrizo	Rattlesnake Mine No. 4	0.4		0.23		0.20		1.92	R G	R	Ariz-cu-30
3537	3660	N. Carrizo	Pit B	2.0		0.37		0.29		2.60	R G	R	Ariz-cu-30
3538	3649	N. Carrizo	Pit B	0.5		0.47		0.46		2.55	R G	R	Ariz-cu-30
3539	3624	N. Carrizo	Mine No. 4	0.6		0.31		0.25		3.19	R G	R	Ariz-cu-30
3540	3639	N. Carrizo	RC-7	0.8		0.32		0.30		2.02	R G	R	Fig.No.47
3541	3659	N. Carrizo	RC-7	0.8		0.30		0.29		1.16	R G	R	Fig.No.47

APPENDIX NO. 3

Exploration Summary

<u>District</u>	<u>Locality</u>	<u>Block</u>	<u>No. of Holes</u>	<u>Avg. Depth in Ft.</u>	<u>Total Ft.</u>	<u>Cost Per Ft.</u>	<u>Total Cost</u>
Cove	Cove Mesa	A	48	40	1,920	\$2.00	\$ 3,840
		B	166	40	6,640	2.00	13,280
		C	26	40	1,040	2.00	2,080
		D	96	40	3,840	2.00	7,680
TOTAL DRILLING			336	40	13,440	2.00	26,880
Kinusta	Kinusta	A	35	30	1,050	2.00	2,100
	Mesa	B	149	35	5,215	2.00	10,430
		C	265	45	11,925	2.00	23,850
TOTAL DRILLING			449	40.5	18,190	2.00	36,380
Toh Acon	Toh Acon Mesa	A	142	30	4,260	2.00	8,520
Sigi Ho	Sigi Ho Cho	A	176	70	12,320	2.00	24,640
Cho	Mesa	B	4	45	180	2.00	360
		C	8	70	560	2.00	1,120
TOTAL DRILLING			188	69.5	13,060	2.00	26,120
Plus 1000 ft. of 4 x 6 ft. drifting						6.00	6,000
TOTAL DRILLING AND DRIFTING							32,120
Sigi Ho	Saytah	C	120	130	15,600	2.00	31,200
Cho	Canyon	D	52	80	4,160	2.00	8,320
TOTAL DRILLING			172	114.9	19,760	2.00	39,520
Sigi Ho	Martin Mesa	A	35	20	700	2.00	1,400
Cho	N. Carrizo	B	920	50	46,000	2.00	92,000
TOTAL DRILLING			955	48.9	46,700	2.00	93,400
GRAND TOTAL DRILLING			2,242	51.5	115,410	2.00	230,820
GRAND TOTAL DRIFTING - 1,000 ft.							6,000
GRAND TOTAL							236,820

Supplemental and Summary Report on
Western Carrizo Uplift and Chuska Mountains Areas of
Northern Navajo Indian Reservation, Arizona

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ORE CALCULATION TABLES

Table A (repeated) Summary Tabulation of Tonnage Estimates
Based on SOQ Grades

Table B (repeated) Summary Tabulation of Weighted %V₂O₅
Grades Corresponding to Tonnages Shown in Table A.

<u>Table</u>	<u>Sheet</u>	<u>Locality</u>	<u>Working</u>	<u>Block</u>
<u>Sigi Ho Cho District</u>				
I	1	Sunnyside Mesa	Sunnyside Mine	1-10
	1	Eurida Mesa	Eurida Mine	1-3
	2	South Saytah Canyon	CBW-MC Mine	1
	2	Martin Mesa	Martin Mine	1-9
	3	North Carrizo	VCA #8 Mine	1-5
	3	North Carrizo	Mine #2	1
	3	North Carrizo	Mine #4	1
	4	North Carrizo	Incline Mine	1-8
II	4	North Carrizo	Mine RC 5	1,2
	1	Sunnyside Mesa	Sunnyside Mine	I,II
	1	Eurida Mesa	Eurida, E. Workings	I,II
	2	Eurida Mesa	Eurida #2 Claim	I-IV
	2	South Saytah Canyon	CBW-MC Mine	I,II
	2	Martin Mesa	Hogan Mine	I
	3	Martin Mesa	Martin Mine	I-IV
	3	Martin Mesa	Saytah Mine	I-III
	3	North Carrizo	VCA #8 Mine	I-IV
	4	North Carrizo	Mine No. 1	III
	4	North Carrizo	Mine No. 2	I,II
	4	North Carrizo	Incline Mine	IV
	4	North Carrizo	Mine No. 3	V
	4	North Carrizo	Pit B	VI-VIII
	5	North Carrizo	Mine No. 4	IX
	5	North Carrizo	Pit C	X
	5	North Carrizo	Mine RC 5	I,II
	5	North Carrizo	Mine RC 7	I-V
	5	North Carrizo	Mine #5	I,II
<u>Cove District</u>				
III	1	Cove Mesa	---	A
	2	Cove Mesa	---	B
	3	Cove Mesa	---	C
	3	Cove Mesa	---	D

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Ore Calculation Tables

<u>Table</u>	<u>Sheet</u>	<u>Locality</u>	<u>Working</u>	<u>Block</u>
<u>Kinusta District</u>				
III	4	Kinusta Mesa	---	A
	5	Kinusta Mesa	---	B
	6	Kinusta Mesa	---	C
<u>Toh Acon District</u>				
	7	Toh Acon Mesa	---	A
<u>Sigi Ho Cho District</u>				
	8	Sigi Ho Cho Mesa	---	A
	8	Sigi Ho Cho Mesa	---	B
	8	Sigi Ho Cho Mesa	---	C
	9	South Saytah Canyon	---	C
	9	South Saytah Canyon	---	D
	10	North Carrizo	---	A
	11,12	Martin Mesas, N. Carrizo	---	B
IV	1	Summary, Positive Ore		
V	1,2	Summary, Indicated Ore		
<u>All Districts</u>				
VI	1,2	Summary, Inferred Ore		
VII	1	Summary of All Classes by Districts and Grades		

Table B

Repeated

SUMMARY TABULATION OF WEIGHTED %V₂O₅ GRADES CORRESPONDING TO TONNAGES SHOWN IN TABLE A
 Cove, Kinusta, Toh Acon, and Sigi Ho Cho Districts
 Chuska Mountains and Carrizo Uplift Areas, Navajo Indian Reservation

Location	Positive Ore			Indicated Ore			Inferred Ore			Wtd. Avg.
	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	
Sigi Ho Cho Dist.										
Sigi Ho Cho Mesa	---	---	---	---	---	---	---	---	1.528	1.528
Sunnyside Mesa	---	2.261	---	---	2.022	---	---	---	---	2.097
Eurida Mesa	---	2.988	---	3.752	4.124	1.693	---	---	---	2.722
Saytah Canyon	---	---	1.313	---	---	1.314	---	1.503	1.361	1.461
Martin Mesa & N. Carrizo	2.716	1.210	---	1.883	1.208	1.460	1.626	1.317	---	1.352
Sigi Ho Cho Dist. Weighted Average	2.716	2.293	1.313	1.978	1.409	1.537	1.626	1.342	1.517	1.441
Cove Dist.	---	---	---	---	---	---	2.172	1.854	---	2.086
Kinusta Dist.	---	---	---	---	---	---	---	---	0.817	0.817
Toh Acon Dist.	---	---	---	---	---	---	---	---	1.628	1.628
WTD.AVG. Grade 1	2.716			1.978			2.081			2.080
Grade 2		2.293			1.409			1.411		1.422
Grade 3			1.313			1.537			1.097	1.098
Wtd. Avg. Pos. -			2.319	Wtd. Avg. Ind. -		1.624	Wtd. Avg. Inf. -		1.300	

WTD.AVG., all types and grades, 399,950 tons at

1.308

Smead MFG. CO.

HASTINGS MN - LOS ANGELES - CHICAGO
LOGAN OH - MCGREGOR TX - LOCUST GROVE GA

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Appendix
Figures, Profiles, and Columns

April 1946

Supplemental and summary Report on
Western Carrizo Uplift and Chuska Mountains areas of
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2	Symbols for Figure Sheets	--
<u>Cove District</u>		
3 Cove Mesa	S-44 and S-48	1" = 40'
4 Cove Mesa	S-30, S-42A, S-45	1" = 20'
5 Cove Mesa	S-39 and S-40	1" = 40'
6 Cove Mesa	S-31, S-32, S-33	1" = 40'
7 Cove Mesa	S-28 and S-28A	1" = 20'
8 Cove Mesa	S-26, S-27, S-4, S-50	1" = 20', 40'
9 Cove Mesa	S-17, S-11, S-14	1" = 20', 40'
10 Cove Mesa	S-5, S-9, S-59	1" = 20', 40'
11 Cove Mesa	S-51, S-52, S-53	1" = 20', 40'
12 Cove Mesa	S-49	1" = 40'
<u>Kinusta District</u>		
13 Kinusta Mesa	Ore Body K-1	1" = 20'
14 Kinusta Mesa	Ore Body K-2	1" = 20'
15 Kinusta Mesa	Ore Body K-2	1" = 20'
16 Kinusta Mesa	Ore Body K-3, K-4	1" = 20'
17 Kinusta Mesa	Ore Body K-5, K-6	1" = 20'
18 Kinusta Mesa	Ore Body K-7	1" = 20'
19 Kinusta Mesa	Ore Body K-8, K-9	1" = 20'
20 Kinusta Mesa	Ore Body K-17, K-18	1" = 20'
21 Kinusta Mesa	Ore Body K-21, K-23	1" = 20'
22 Kinusta Mesa	Ore Body K-24	1" = 20'
23 Kinusta Mesa	Ore Body K-27	1" = 20'
<u>Sigi Ho Cho District</u>		
24 Sigi Ho Cho Mesa	Outcrop 8A	1" = 20'
25 Sunnyside Mesa	Sunnyside Mine	1" = 40'
26 Eurida Mesa	Eurida Mine	1" = 40'
27 Eurida Mesa	Eurida Mine, East Workings	1" = 40'
28 Eurida Mesa	East End, Eurida Mesa	1" = 20'
29 Eurida Mesa	Eurida No. 2 Claim	1" = 40'
30 Eurida Mesa	Eurida Claim - VCA	1" = 40'
31 Eurida Mesa	Outcrops 35 and 37	1" = 20'
32 Saytah Canyon	CBW-MC Mine	1" = 20'
33 Saytah Canyon	Outcrops S-1 and CB&W-15	1" = 20'
34 Saytah Canyon	Outcrop S-3	1" = 20'
35 Saytah Canyon	Sketch, showing ore blocks	1" = 500'

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<u>No.</u>	<u>Locality</u>	<u>Title</u>	<u>Scale</u>
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37	Martin Mesa	Outcrops M-3 and NC-3	1" = 20', 40'
38	Martin Mesa	North Martin Mine	1" = 40'
39	Martin Mesa	Martin Mine	1" = 40'
40	Martin Mesa	Saytah Mine	1" = 20'
41	North Carrizo	Pits, Vicinity Lease No. 3	1" = 40'
42	North Carrizo	VCA No. 8 Mine	1" = 40'
43	North Carrizo	Outcrop NC-2	1" = 10'
44	North Carrizo	Mine No. 5	1" = 40'
45	North Carrizo	East Pits	1" = 40'
46	North Carrizo	Mine RC-5 and Pit RC-1	1" = 40'
47	North Carrizo	Mine RC-7	1" = 40'

Teec Nos Pas District

48	Teec Nos Pas	Sketch Map of VCA Lease	1" = 2000'
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PROFILES AND COLUMNAR SECTIONS (Scale: 1" = 40')

<u>District</u>	<u>Location</u>	<u>Profile No.</u>	<u>Columnar Section No.</u>
Kinusta	Kinusta Mesa	1,2	1,2
Toh Acon	Toh Acon Mesa		1 thru 9
Sigi Ho Cho	Carrizo Mountains		3
Sigi Ho Cho	Saytah Canyon		4
Sigi Ho Cho	Martin Mesa		5 thru 12
Sigi Ho Cho	North Carrizo	6	13,14,15

CHECK LIST - REPRODUCIBLES FOR FIGURES, PROFILES & COLUMNS
(Book No. 1)

WESTERN CARRIZO UPLIFT & CHUSKA MTS. AREAS
NORTHERN NAVAJO INDIAN RESERVATION
NORTHEASTERN ARIZONA

Figures

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1		x	25	x	x
1A		x	26	x	x
2	x	x	27	x	x
3	x	x	28	x	x
4	x	x	29	x	x
5	x	x	30	x	
6	x	x	31	x	x
7	x	x	32	x	x
8	x	x	33	x	x
9	x	x	34	x	x
10	x	x	35	x	x
11	x	x	36	x	x
12	x	x	37	x	x
13		x	38	x	x
14		x	39	x	x
15		x	40	x	x
16		x	41	x	x
17		x	42	x	x
18		x	43	x	x
19		x	44	x	x
20		x	45	x	
21		x	46	x	x
22		x	47	x	x
23		x	48	x	
24	x	x			

Profiles

Kinusta District
Carrizo Uplift Area

<u>Profile No.</u>	<u>Tracing</u>
1	x
2	x

North Carrizo Locality

<u>Profile No.</u>	<u>Tracing</u>
6	x

CHECK LIST - REPRODUCIBLES FOR FIGURES, PROFILES & COLUMNS
(Book No. 1)

WESTERN CARRIZO UPLIFT & CHUSKA MTS. AREAS
NORTHERN NAVAJO INDIAN RESERVATION
NORTHEASTERN ARIZONA

Columns

Kinusta District
Carrizo Uplift Area

<u>Column No.</u>	<u>Tracing</u>
1	x
2	x

Toa Acon District
Carrizo Uplift Area

<u>Column No.</u>	<u>Tracing</u>
1	x
2	x
3	x
4	x
5	x
6	x
7	x
8	x
9	x

Carrizo Mountains Locality
Sigi Ho Cho District
Carrizo Uplift Area

<u>Column No.</u>	<u>Tracing</u>
3	x

Saytah Canyon Locality
Sigi Ho Cho District
Carrizo Uplift Area

<u>Column No.</u>	<u>Tracing</u>
4	x

Martin Mesa Locality
Sigi Ho Cho District
Carrizo Uplift Area

<u>Column No.</u>	<u>Tracing</u>
5	x
6	x
7	x
8	x

CHECK LIST - REPRODUCIBLES FOR FIGURES, PROFILES & COLUMNS
(Book No. 1)

WESTERN CARRIZO UPLIFT & CHUSKA MTS. AREAS
NORTHERN NAVAJO INDIAN RESERVATION
NORTHEASTERN ARIZONA

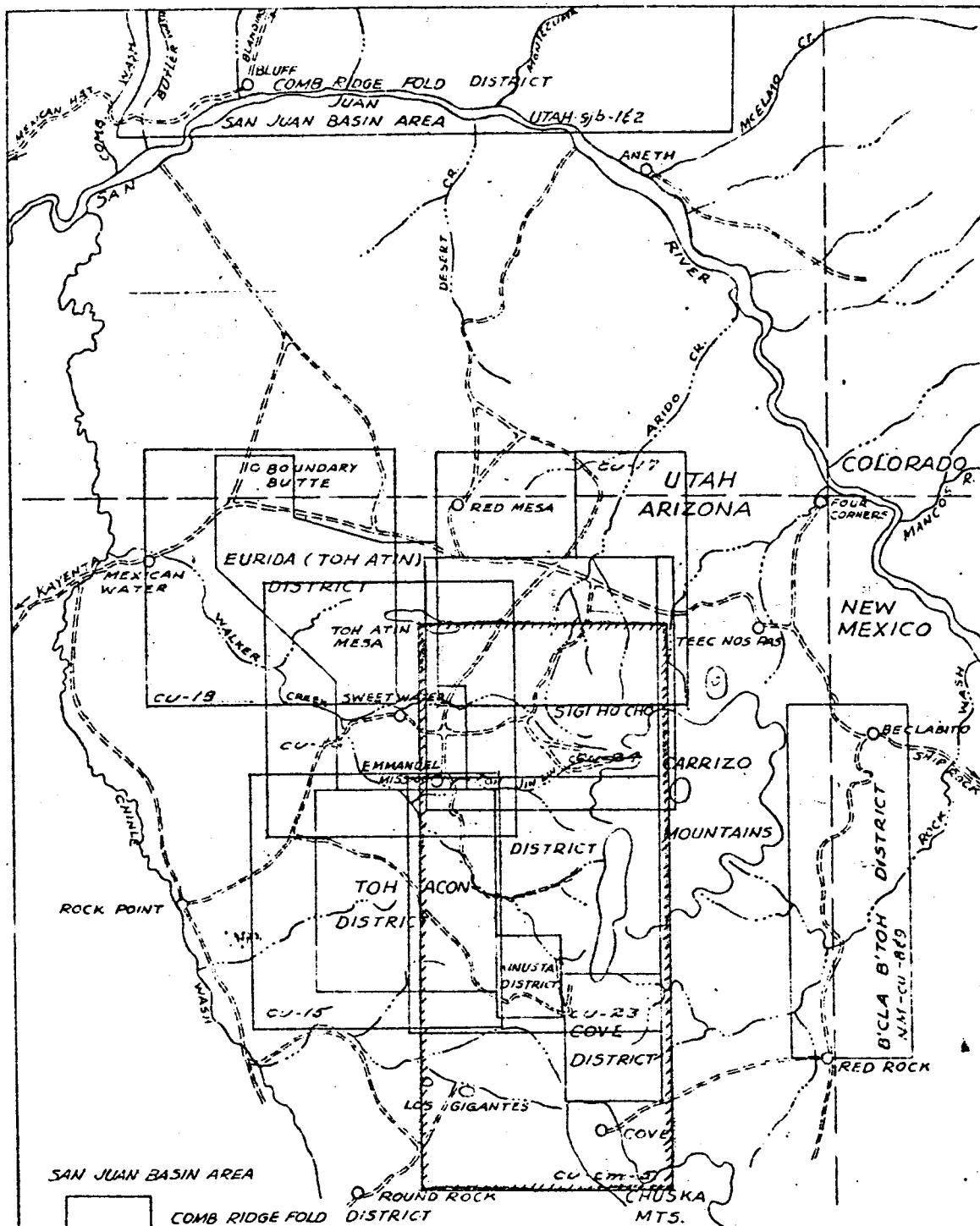
Columns

Martin Mesa Locality
Sigi Ho Cho District (cont.)
Carrizo Uplift Area

<u>Column No.</u>	<u>Tracing</u>
9	x
10	x
11	x
12	x

North Carrizo Locality
Sigi Ho Cho District
Carrizo Uplift Area

<u>Column No.</u>	<u>Tracing</u>
13	x
14	x
15	x

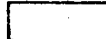


SAN JUAN BASIN AREA

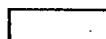


COMB RIDGE FOLD DISTRICT

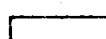
CARRIZO UPLIFT AREA



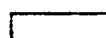
EURIDA (TOHATIN) DISTRICT



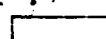
SIGI HO CHO DISTRICT



TOH ACON DISTRICT



KINUSTA DISTRICT



B'CLA B'TOH DISTRICT

CHUSKA MOUNTAIN AREA



COVE DISTRICT

(AREAL MAPS —)
FIG. 1-A INDEX MAP

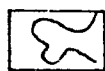
UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

DISTRICTS IN AND ADJACENT TO THE
NORTHERN NAVAJO INDIAN RES.

SCALE: 1:500,000

TAKEN FROM U.S.C.G.S. AERO CHARTS
AND INDIAN SERVICE MAP

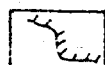
SYMBOLS FOR FIGURE SHEETS



Underground Workings.



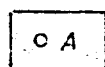
Surface workings and open pits.



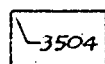
Cliff



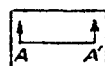
Waste dump



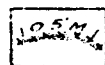
Survey station



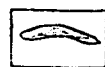
Location and field number of samples.



Location of section.



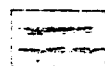
SOM-Vanadium mineralization on plan views. Figures refer to avg. thickness; letters-est. V_2O_5 grade: L-low, M-medium, H-high.



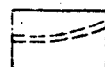
SOM-vanadium mineralization in section views.



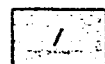
Sandstone in section views.



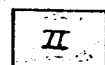
Mudstone & shale partings in section views.



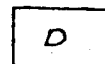
Unimproved dirt roads.



Positive ore block



Indicated ore block



Inferred ore block

FIGURE NO 2

UNION MINES DEVELOPMENT CORP
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO LIFT AND
CHUSKA MTS. AREAS
SIGI HO CHO, KINUSTA,
AND COVE DISTRICTS
SYMBOLS FOR FIGURE SHEETS

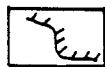
SYMBOLS FOR FIGURE SHEETS



Underground Workings.



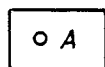
Surface Workings and open pits.



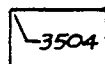
Cliff



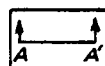
Waste dump



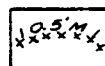
Survey station



Location and field number of samples.



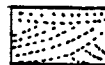
Location of section.



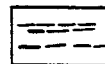
SOM-Vanadium mineralization on plan views. Figures refer to avg. thickness; letters-est. V_2O_5 grade: L-low, M-medium, H-high.



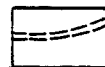
SOM-vanadium mineralization in section views.



Sandstone in section Views.



Mudstone & shale partings in section views.



Unimproved dirt roads.

FIGURE NO. 2

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AND
CHUSKA MTS. AREAS
SIGI HO CHO, KINUSTA,
AND COVE DISTRICTS

SYMBOLS FOR FIGURE SHEETS

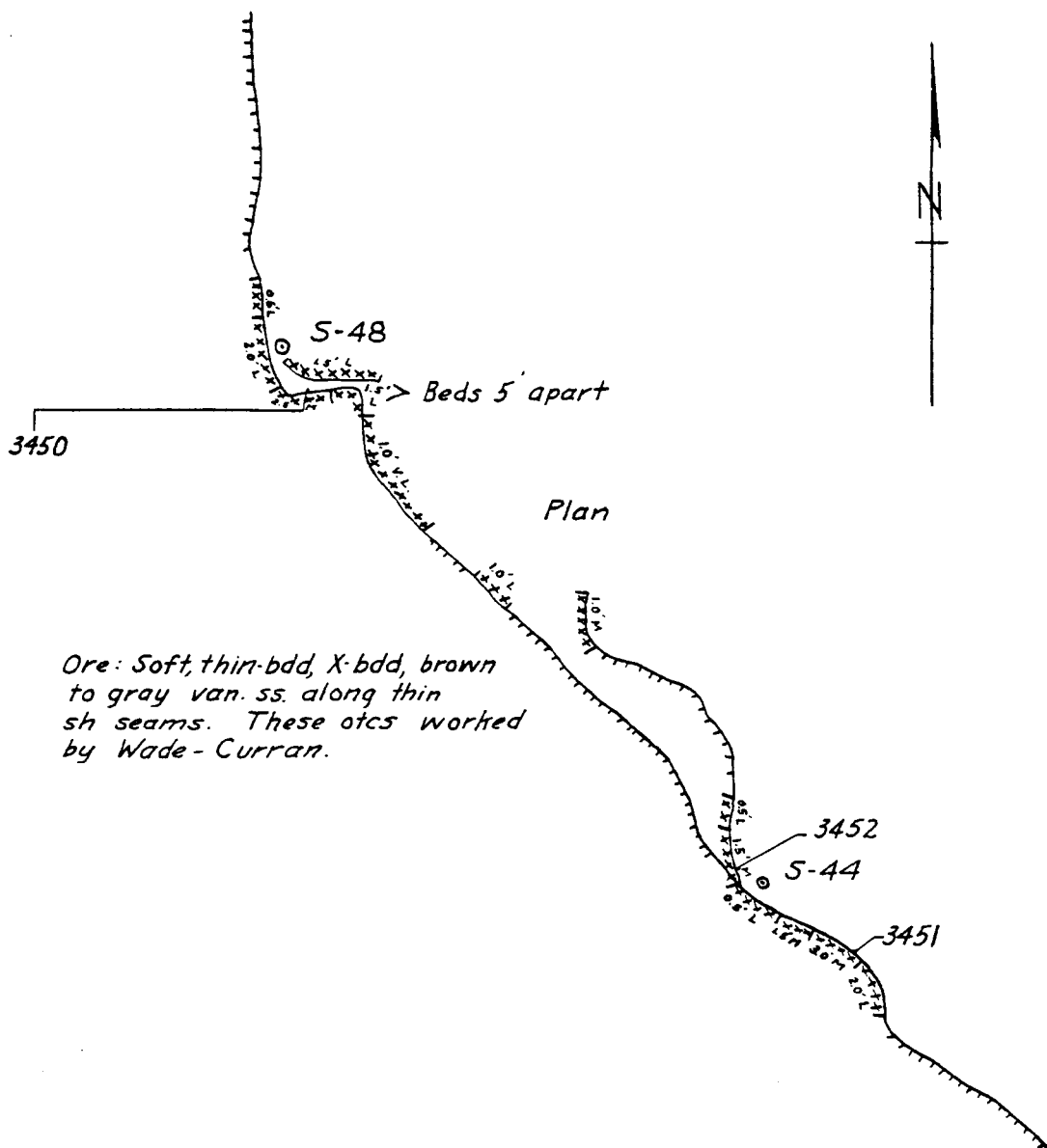


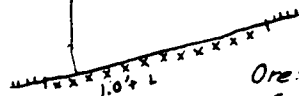
FIGURE NO. 3

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

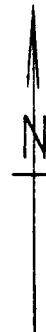
CHUSKA MTNS AREA
COVE DISTRICT
S-44 & S-48
Scale: 1"=40' 8-2-45
Party 3

3459

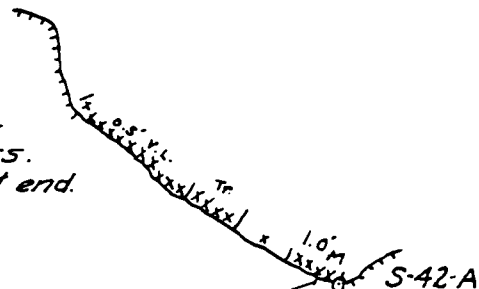
S-30



Ore: Calc. van. ss.; bottom
of otc talus-covered.



Ore: Thin-bdd, gray-streaked, mod-
calcareous, fine to med-gr, van. ss.
Disseminated carnotite at east end.



3480

Ore: Mod. calcareous, gray,
fine-gr, van. ss.

3453

S-45

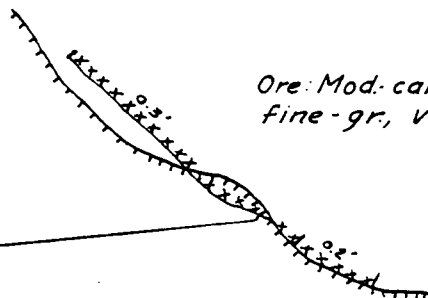
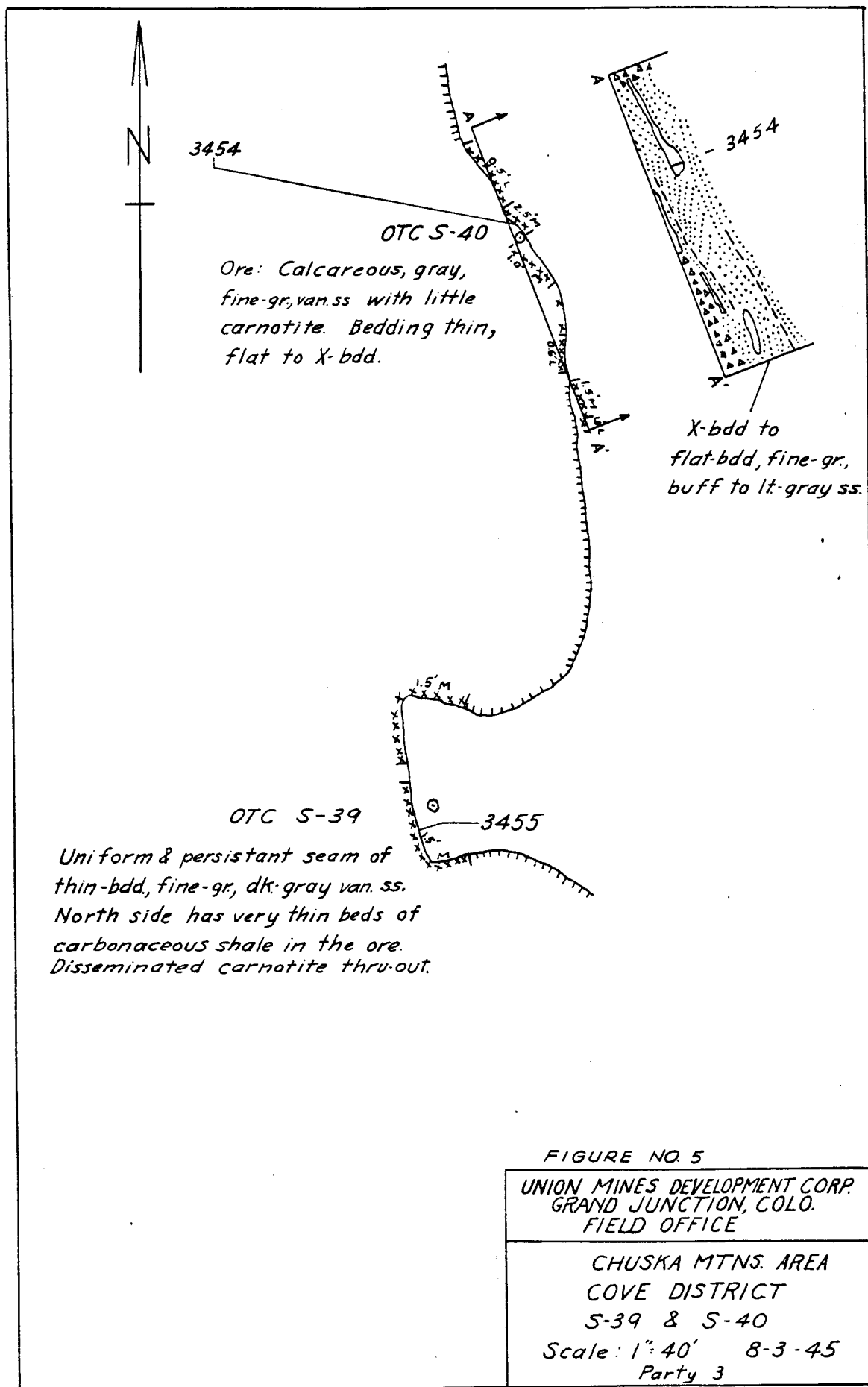
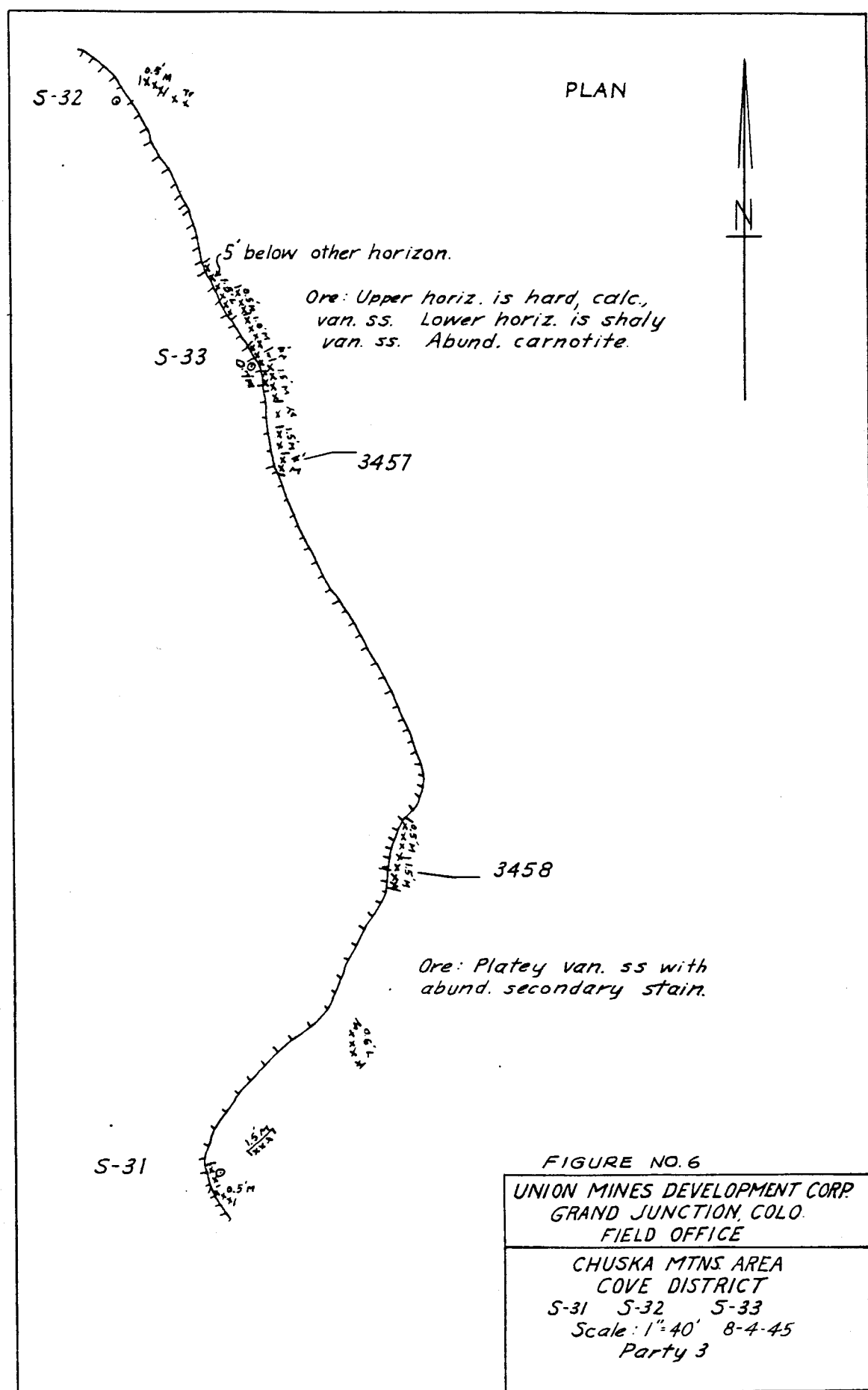


FIGURE NO. 4

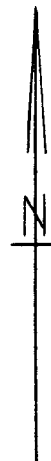
UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CHUSKA MTNS. AREA
COVE DISTRICT
S-30 S-42A S-45
Scale: 1"=20' 8-3-45
Party 3





PLAN



S-32

5' below other horizon.

Ore: Upper horiz. is hard, calc.,
van. ss. Lower horiz. is shaly
van. ss. Abund. carnotite.

S-33

3457

3458

Ore: Platey van. ss with
abund. secondary stain.

S-31

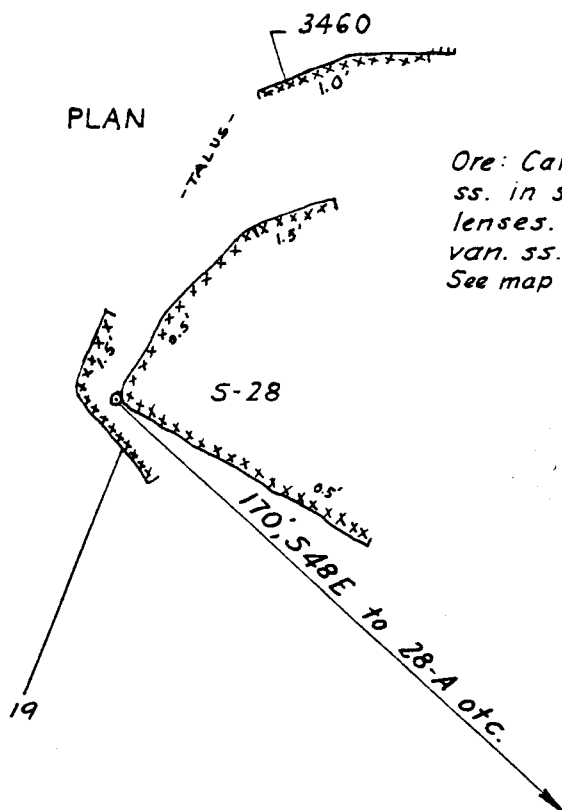
FIGURE NO. 6

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CHUSKA MTNS AREA
COVE DISTRICT

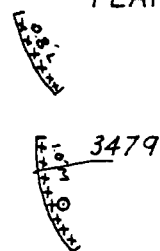
S-31 S-32 S-33
Scale: 1"=40' 8-4-45
Party 3

PLAN



Ore: Calcareous, gray, van. ss. in stringers & small lenses. North end is shaly van. ss. Little carnotite. See map (Ariz. cm-3) for section.

PLAN



S-28-A

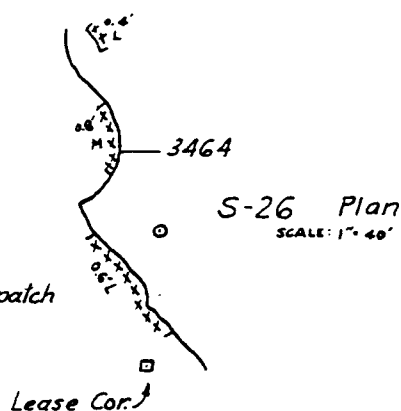
Ore: Gray, fine-grained, van. ss with some disseminated carnotite. Talus-covered to south.

FIGURE NO. 7

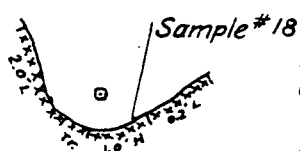
UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CHUSKA MTNS. AREA
COVE DISTRICT
S-28 & 28-A
Scale: 1"=20' 8-5-45
Party 3

Ore: Thin-bdd, X-bdd,
med-gr, friable, calc.,
very-streaked, van. ss
with, small amt. dissem-
inated carnotite. Small patch
at N. end is 15' higher.

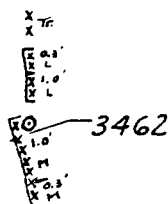


S-27
SCALE: 1" = 40'

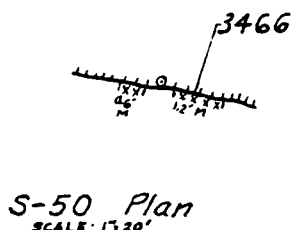


Ore: Thin-bdd, dk. gray, van. ss. with
abund. carnotite. Streaks of
calc, thin-bdd. ss with abund. carn-
otite intercalated with van. ore seam.
Thin, ephemeral, lowgrade, shaly, van. ss.
seam 4' above main seam. Secondary
stain patches between S-26 & S-27.

S-4 Plan
SCALE: 1" = 20'



Ore: Hard, calc, platy, dk.
gray to purple, van. ss with
several barren streaks &
some carnotite.

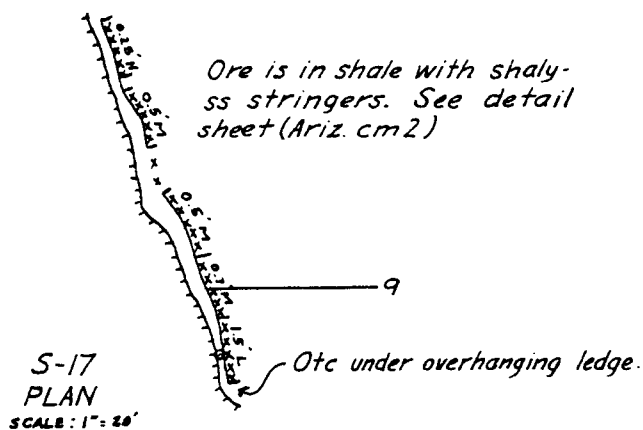


Ore: X-bdd, calc, hard, thin-bdd, van. ss,
streaked, with fair amt. carnotite. Some
buckskin minlz., also manganese stain.
Overlain & underlain by X-bdd, buff ss.

FIGURE NO. 8

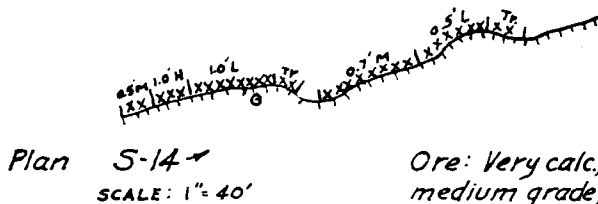
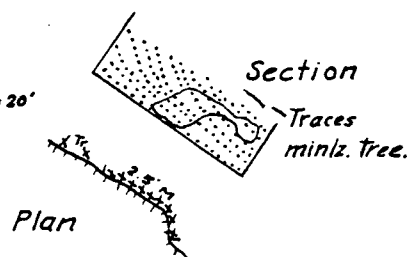
UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CHUSKA MTNS. AREA
COVE DISTRICT
S-26 S-27 S-4 S-50
Scale: As noted. 8-8-45
Party 3



Ore: Patches higrade, X-bdd, van. ss. with barren patches of calc. concretions.
Note: Otc matches orig. map location but not description.

S-11
SCALE: 1" = 20'



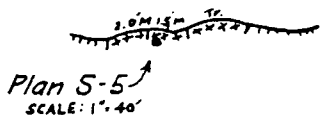
Ore: Very calc., thin-bdd. & streaked, low to medium grade, fine-gr., van. ss near top of 20' cliff of fine-gr., buff ss. Disseminated carnotite & manganese stain in ore. Project sample from S-13 etc.

FIGURE NO. 9

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CHUSKA MTNS. AREA
COVE DISTRICT
S-17 S-11 S-14
Scale: As noted. 8-8-45
Party 3

3477

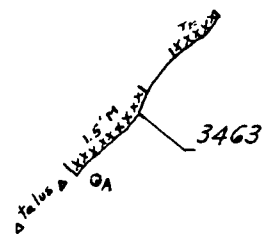


Ore: Uniform bed of thin- to mass. bdd, fine-gr. streaked van. ss. Visible carnotite at west end. Few barren calcareous streaks.

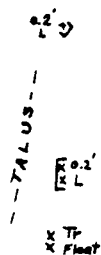
Sta. V Δ

S-9
Plan
SCALE: 1"=20'

Ore: Thin. bdd, fine-gr., friable, shaly, gray, van. ss. 3 1"-thick, hard, calc, buff ss seams with disseminated carnotite in main ore bed, 6" apart.



S-59 Plan
SCALE: 1"=20'



Ore: Poorly-exposed, calc, van. ss. mostly weakly mineralized.



FIGURE NO. 10

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CHUSKA MTNS. AREA
COVE DISTRICT
S-5 S-9 S-59
Scale: As noted. 8-8-45
Party 3

S-51 Plan
SCALE: 1" = 40'

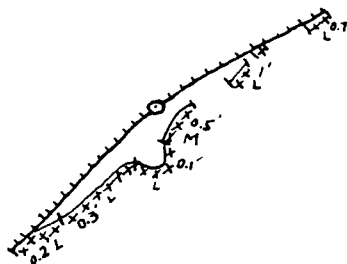
3467
Ore: Dk-gray, to brown, cak, X-bdd, var. ss overlain by shaly trash pocket. Clay galls & limonite. Abund. carnotite.

Ore: Lt-gray, gently X-bdd, med. gr. s var. ss along shale parting. Hematite specks & few clay galls. No carnotite.

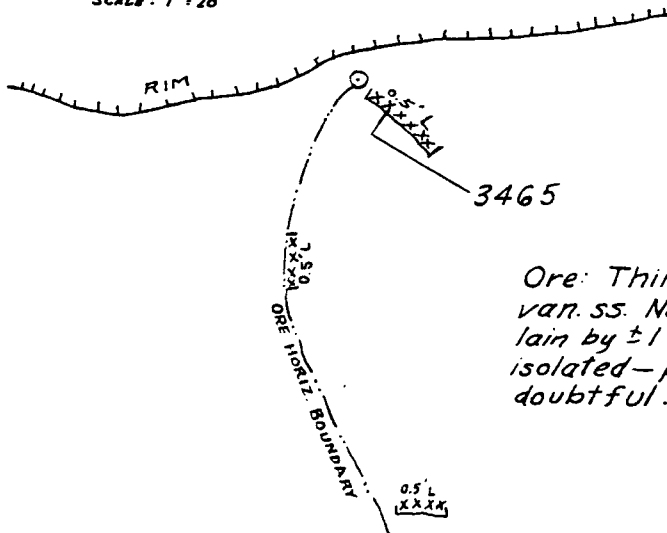


S-52 Plan
SCALE: 1" = 20'

Ore: Thin-bdd, gray var. ss in mass. ss lens. Cross-bedding prominent. Some carnotite.



S-53 Plan
SCALE: 1" = 20'



Ore: Thin-bdd, med. gr, weakly-minlz. var. ss. No visible carnotite. Underlain by $\pm 1'$ sh seam. Ores are isolated—projection of ore is doubtful.

FIGURE NO. 11

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CHUSKA MTNS. AREA
COVE DISTRICT
S-51 S-52 S-53
Scale: As noted 8-9-45
Party 3

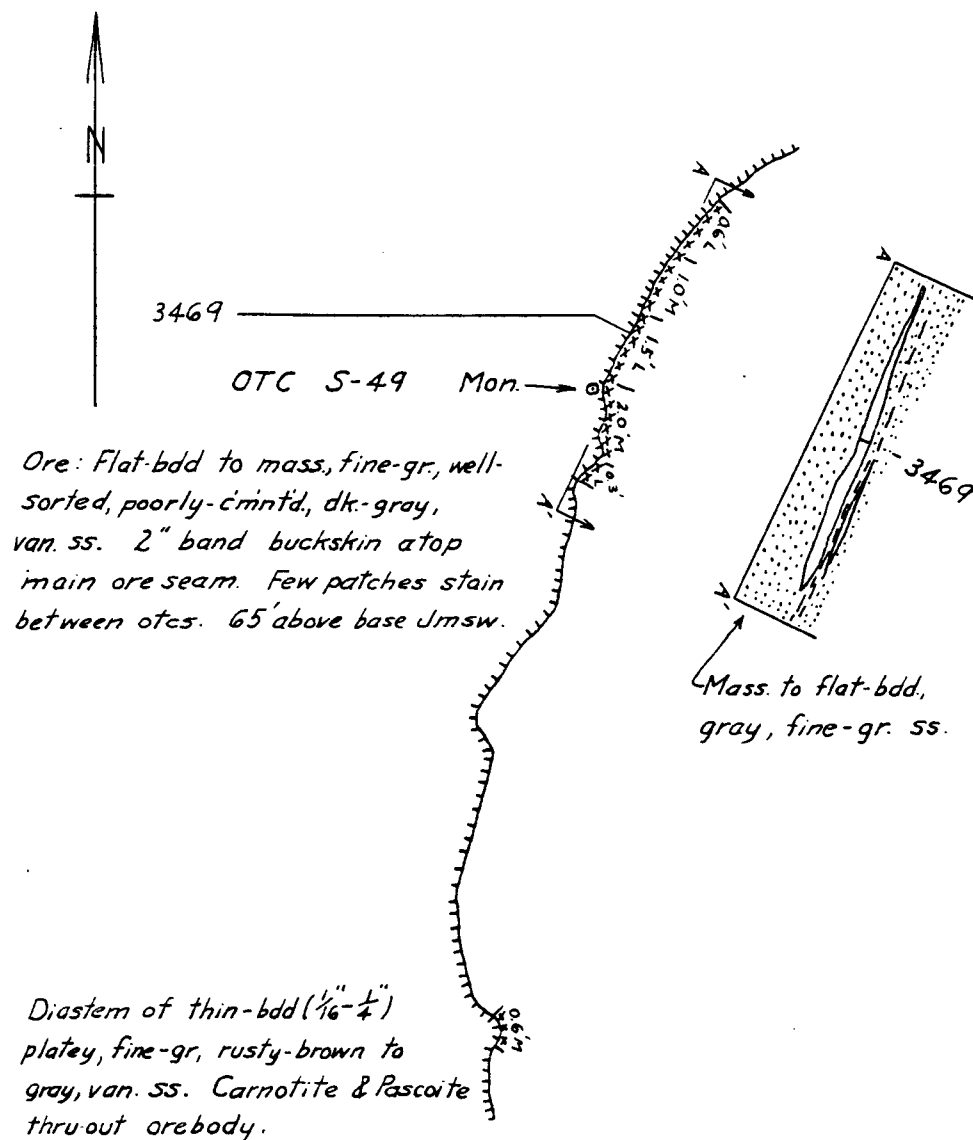


FIGURE NO. 12

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION COLO.
FIELD OFFICE

CHUSKA MTNS. AREA
COVE DISTRICT
S-49

Scale: 1" = 40' 8-2-45
Party 3

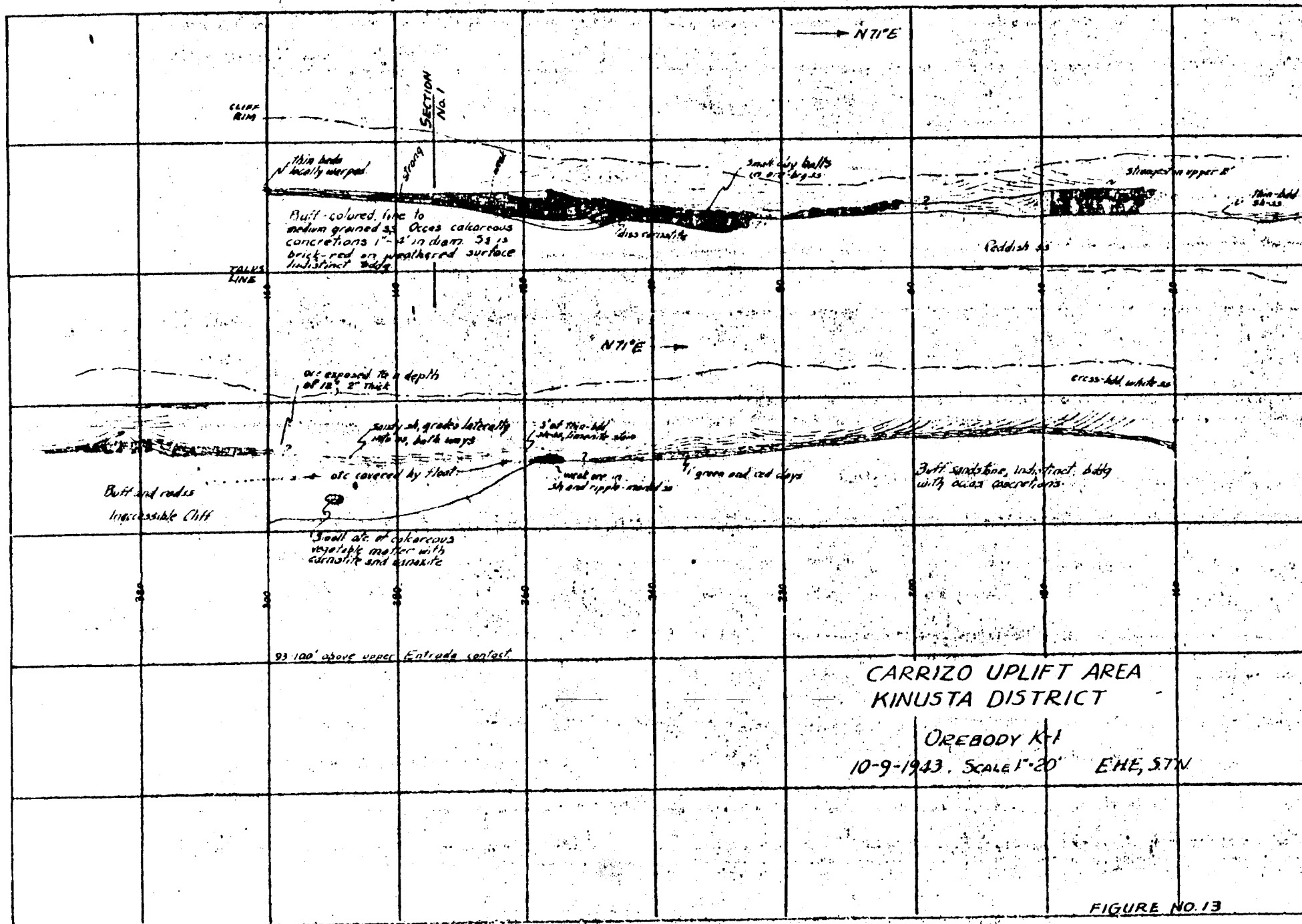
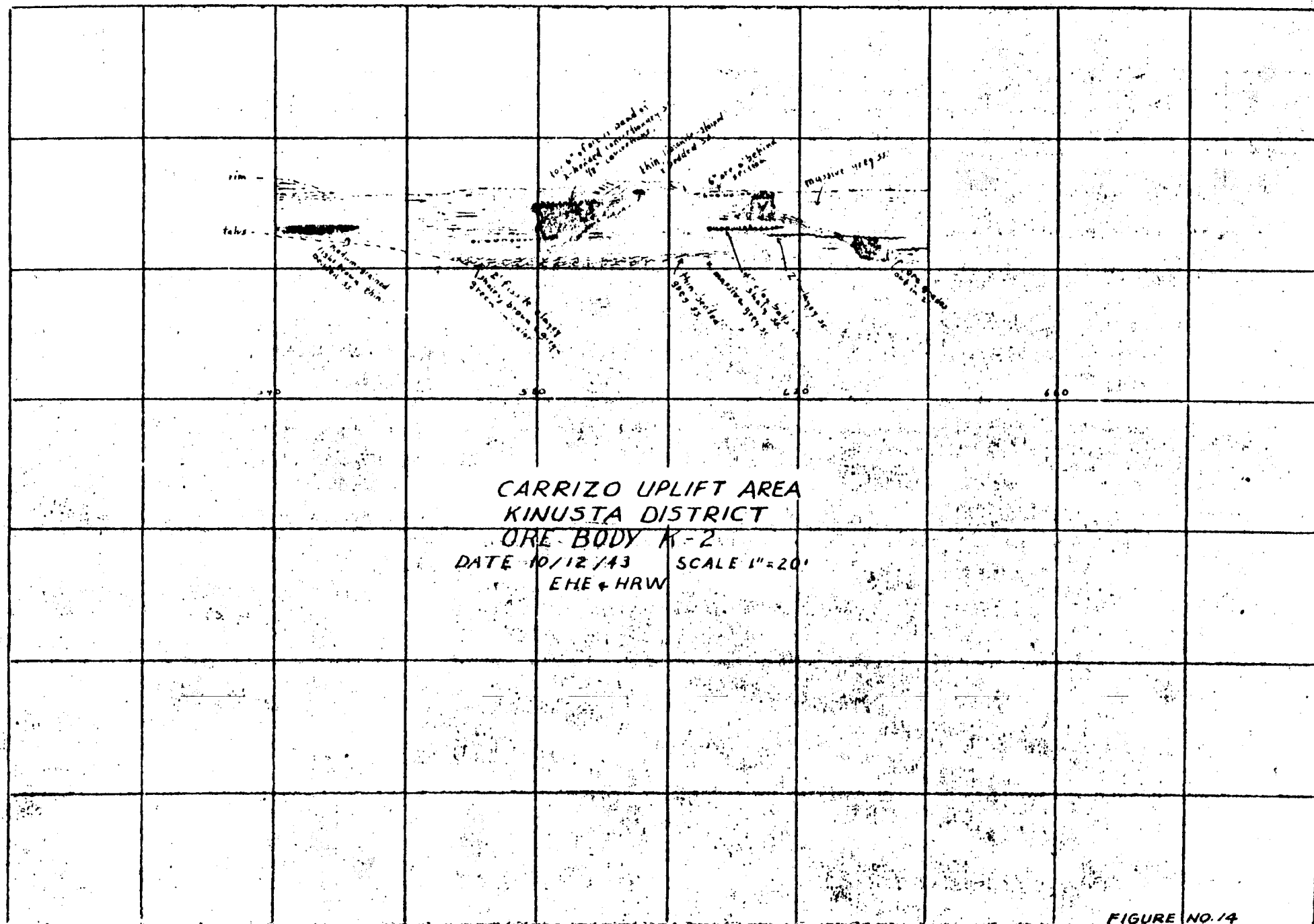
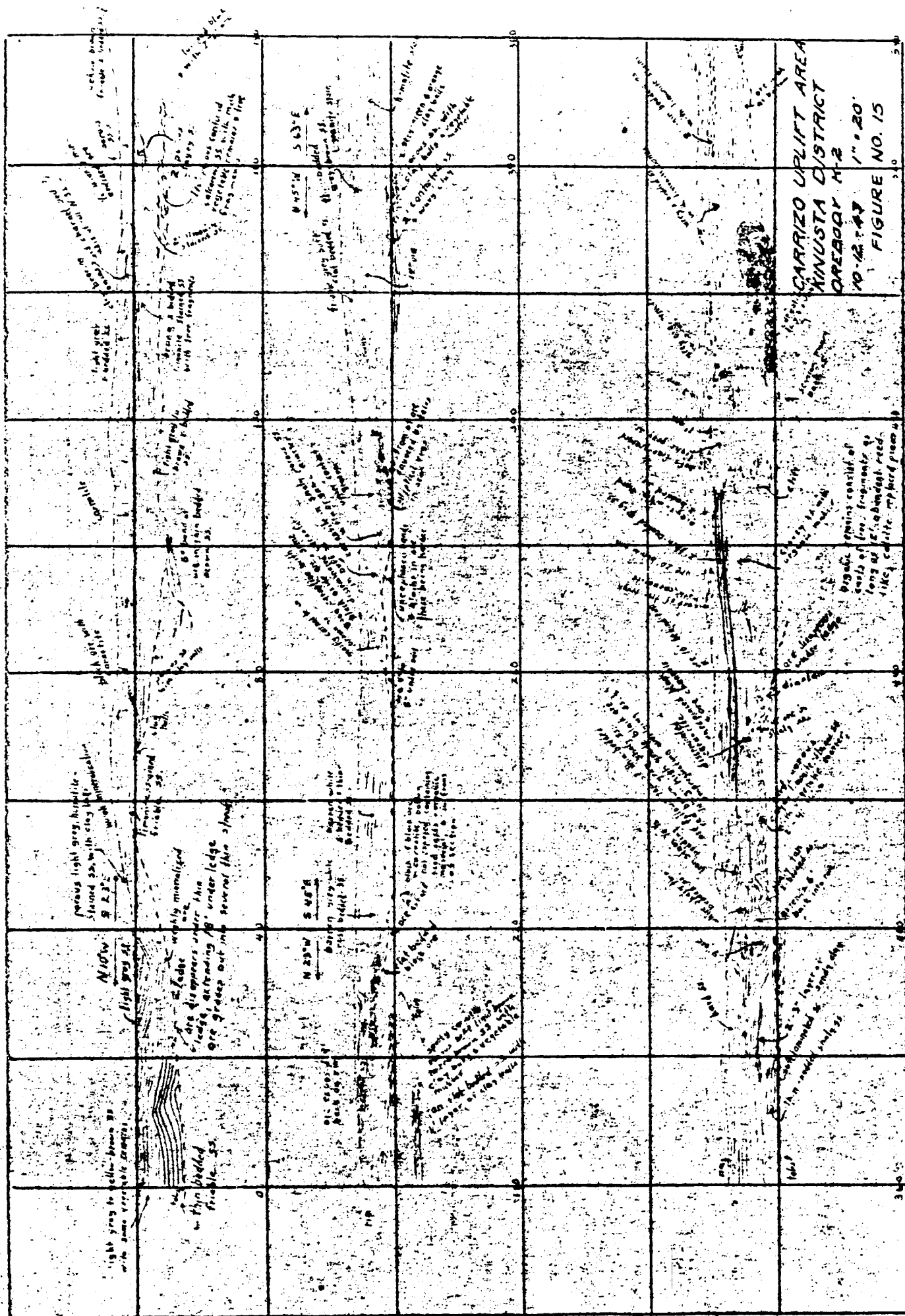


FIGURE NO. 13





CARRIZO UPLIFT AREA
KINUSTA DISTRICT

Date 10/14/43 Scale 1"=20'
HRW • PP

SW

NE

Direction of Section W 35° E

Ore Body K-3

Ore horizon is 25' above Entrada ss

Ore horizon is 53' above Entrada ss

Section is North-South

PP & HRW

South

Ore Body K-4

Ore horizon underlain by massive X-bedded grey-white ss, brown stained surface

FIGURE NO. 16

CARRIZO UPLIFT AREA
KINUSTA DISTRICT

Date: 10/15/43
Scale 1" = 20'

ORE BODY K-6
DATE 10/16/43 HRV:PP
DIRECTION OF SECTION S 5° E
ORE HORIZON IS 60' ABOVE ENTRADA S.S.

FIGURE NO. 17

Massive, gray, X-bedded S.S. stained brown and black.

West
#0

East

Ore Body K-5

Direction of Section S 80° W
Ore horizon is 40' above Entrada ss

Low grade black ore
with strong corundum
stain in gray ss. cut
off by talus
1/2" black bands & spots of ore
in overlying ss
15' low grade ore in porous
Fe-stained concretionary
ss with shale and bedding
X-bedded ss. Ore is black
and yellow-stained corundum
18" ore - 6" thin bed
chert and porous
14" corundum-green
corundum green-stained ss.

Ore lies under 6" limonite-stained
brown colored clay ss. sh. bed
clay balls
cream colored clay ss. sh. bed
low grade massive intensively
stained by green
hard hematite ss
5' bed

Ore lies under thin bedded
gray ss. bed
Ore 2' below the
limonite-stained strongly
bedded gray ss with
limonite bands
Ore apparently thin out into barren
90' omission in section

Ore lies under yellow massive
gray ss. with
limonite-stained ss. with
limonite bands of hematite
Ore lies under massive gray
ss. with
limonite-stained ss. with
limonite bands of hematite
Intense hematite stain on surface almost
completely masks exposure of ore in
this deposit

North
240
180
120
60
0
South

CARRIZO UPLIFT AREA

KINUSTA DISTRICT

Ore Body K-7

DATE 10/17/43 SCALE 1"=20'

Ore horizon is 55' above Entrada ss.
Direction of Section is S 50°W

HRW & STN

ore lies under gray-brown
bedded ss. with limonite
ore with limonite
ore lies over some ss bed
(4%) grey ss.
ore lies over thin bedded
trace of bedded ore in
thick bedded grey ss.
with dark specks
possibly ore
low grade ore in
thin grey friable ss.
beds with fine bands
of limonite
ore crosses over
bedding
low grade ore is in thick bed
grey brown ss.
SW

FIGURE NO. 18

KINGSTON DISTRICT

W.F.S.N.

W.F.S.N.

QEEBODY-K8

EXP-51-01

OREBODY K9

10-15-1943

FIGURE NO. 19

Org 13 18-23' above
Morrison - Entrada (R)

sandstone, clay ss

granite in clay-bearing ss

one dip 300' into fault

50'

N 39° E —

4

rim

2 1/2 - 3' purple, fr stained as
once stained black above.
Takes for 3000' buried 11.

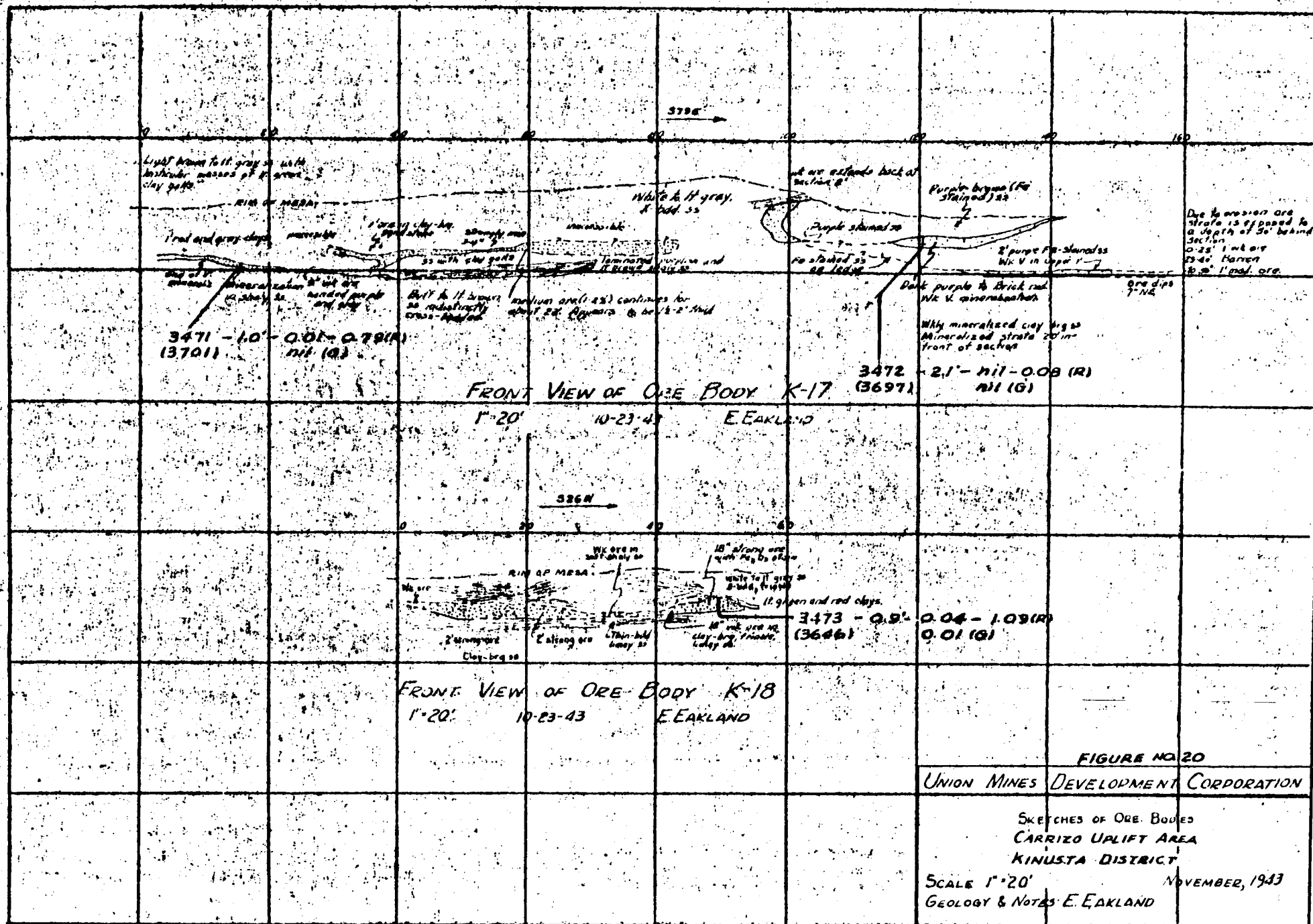
11

TALUS

Dec. 20, 1900

By order of the Court,

4



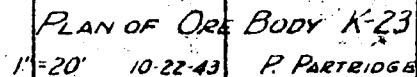
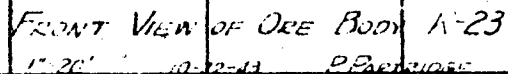
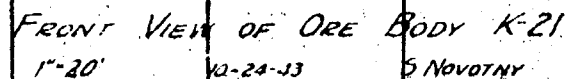


FIGURE NO. 21

UNION MINES DEVELOPMENT CORPORATION

SKETCHES OF ORE BODIES
CARRIZO UPLIFT AREA
KINUSTA DISTRICT
SCALE 1"=20' NOVEMBER, 1943
GEOLOGY & NOTES: S. NOVATNY, P. PATRIDGE

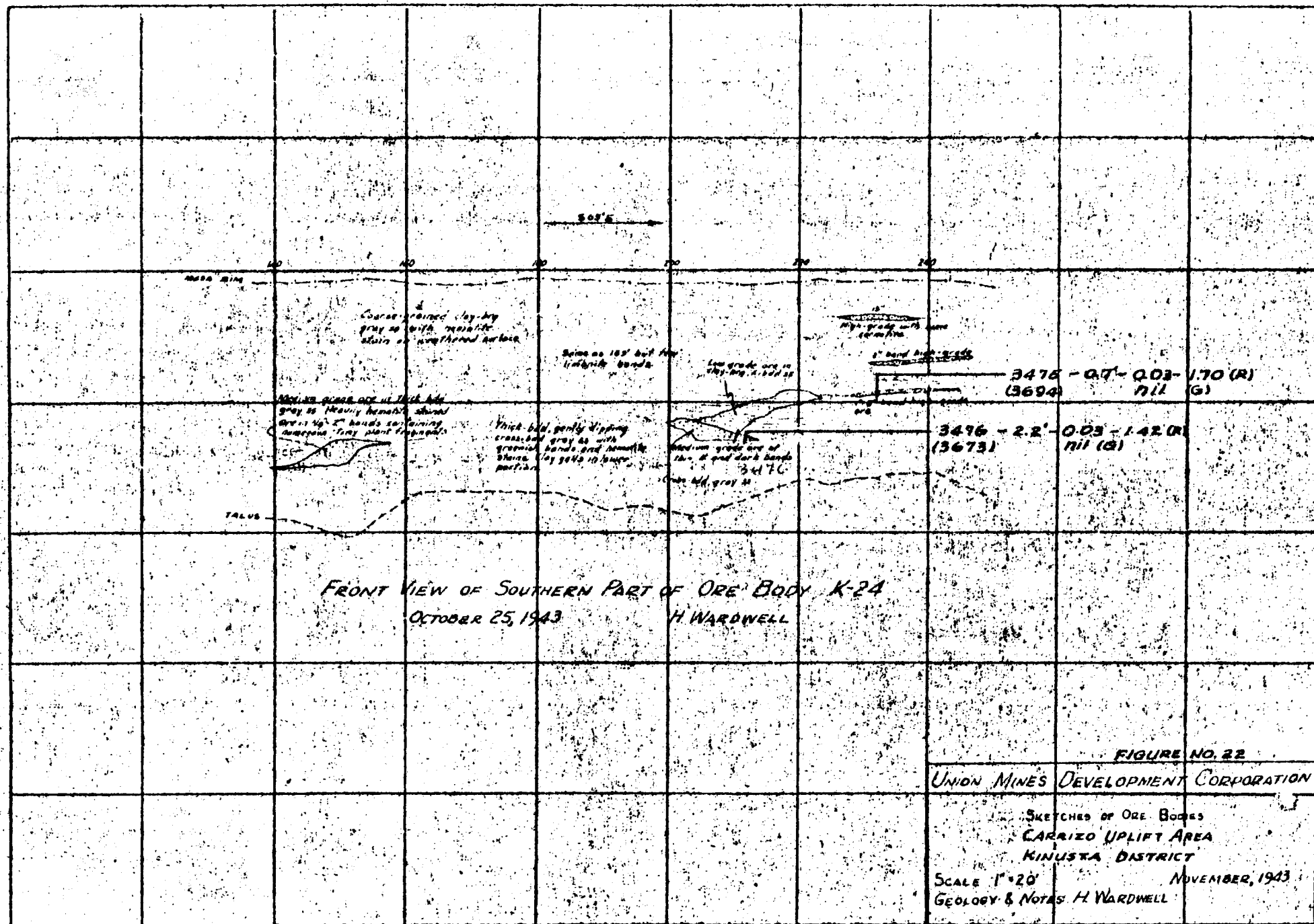


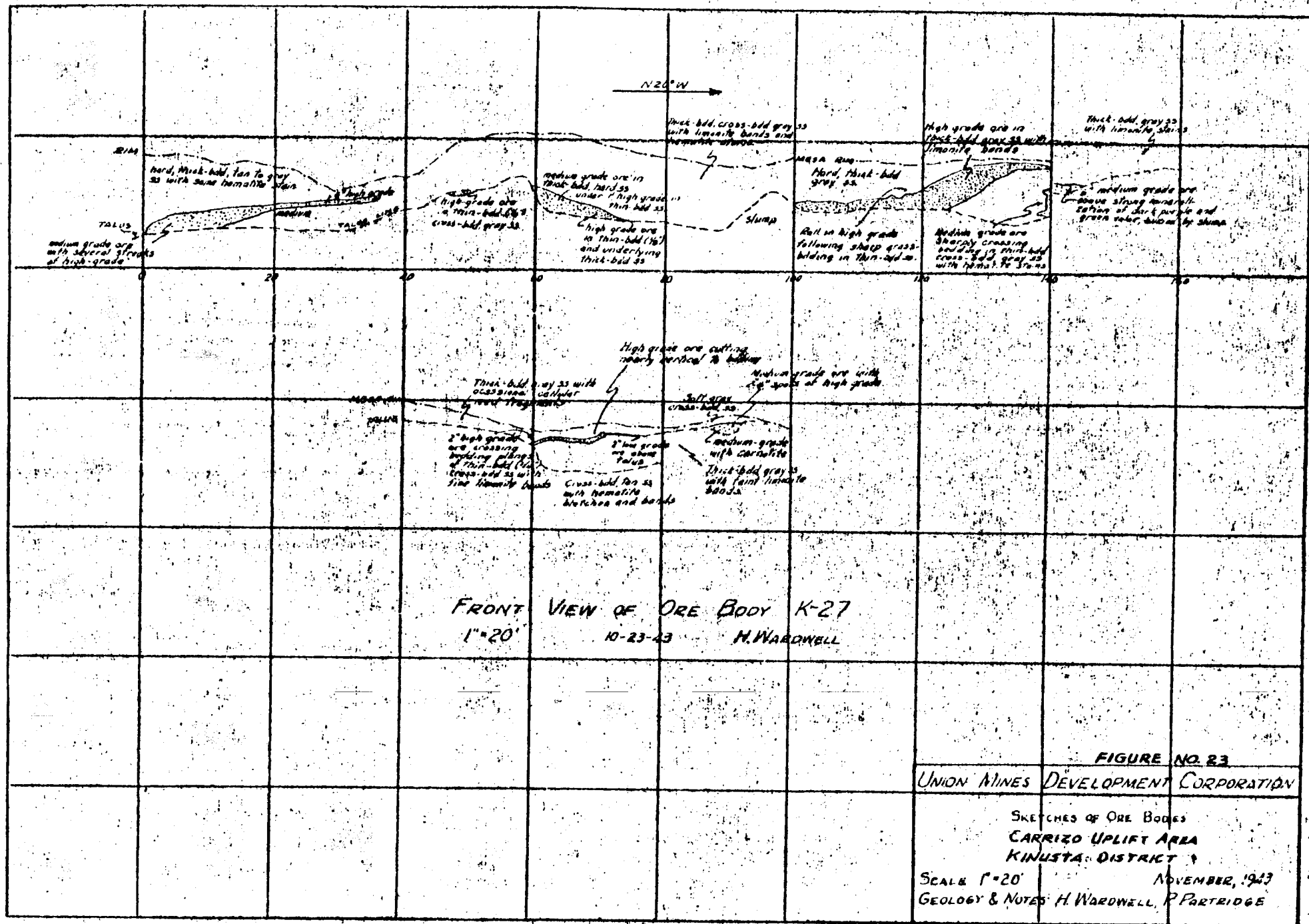
FIGURE NO. 22

UNION MINES DEVELOPMENT CORPORATION

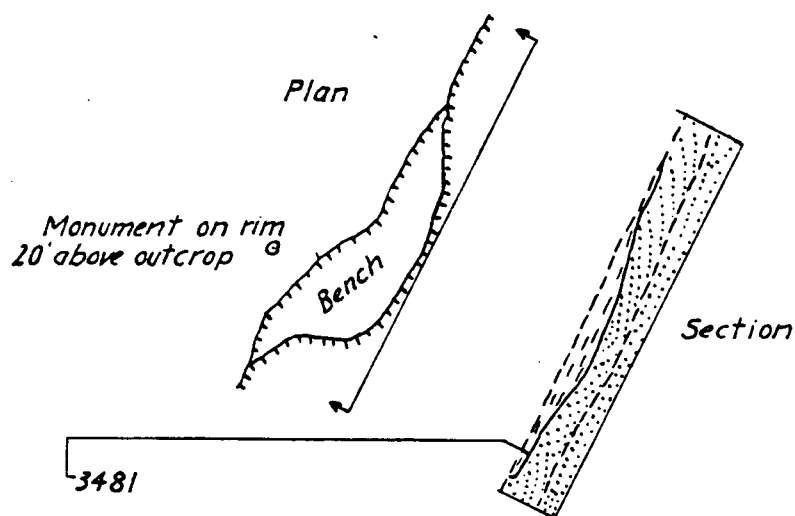
SKETCHES OF ORE BODIES
CARRIZO UPLIFT AREA
KINUSKA DISTRICT

SCALE 1"=20'
GEOLOGY & NOTES H. WARDWELL

NOVEMBER, 1943



Otc 8-A



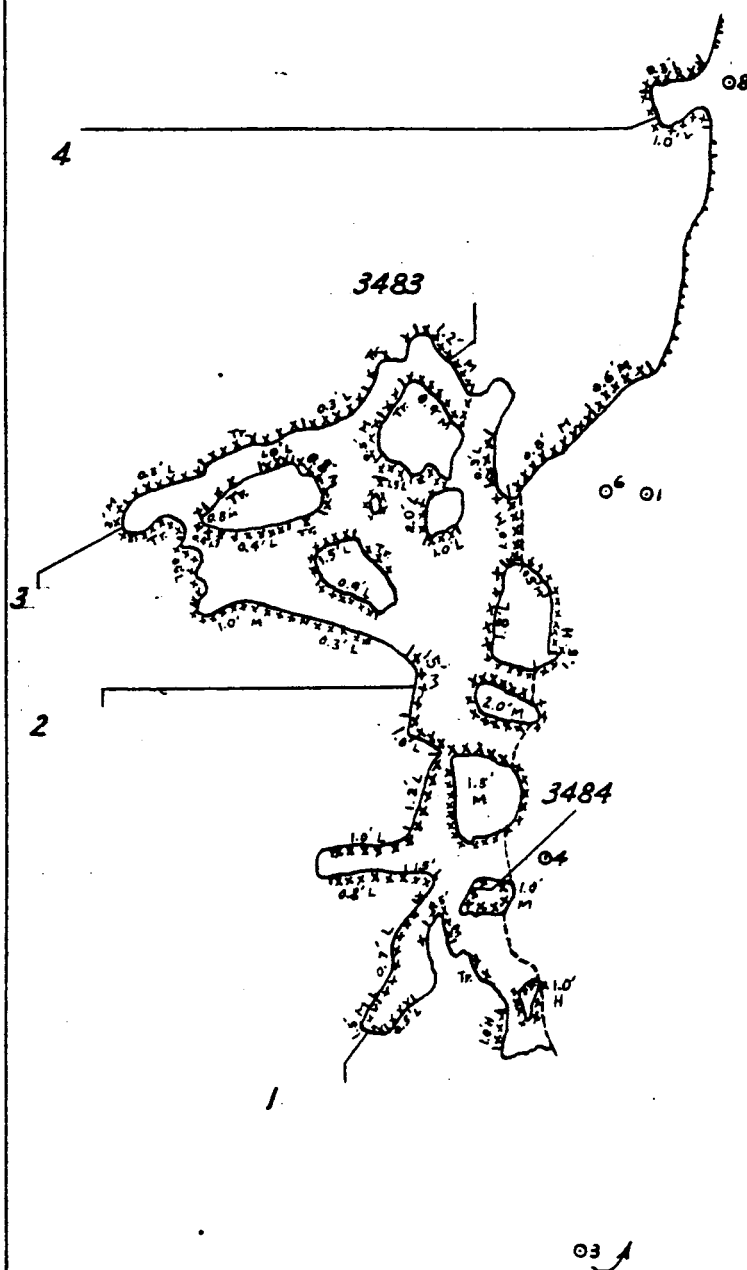
Ore: Medium gray, shaly, van.
ss with no carbonaceous material,
some secondary stain. Bottom half
is platy.

FIGURE NO. 24

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HOCHO DISTRICT
Otc 8-A SIGI HOCHO MESA
Scale: 1" = 20' 8-19-45
S.K.S.

Note: Pt. 4 corresponds to
pt. 4 below.



SUNNYSIDE MINE

Escarpment to South of workings

FIGURE NO. 25

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
SUNNYSIDE MINE

Scale: 1"=40' 8-28-45

JWH. S.K.S.

Revised from Party #2 detail sheet.

PLAN

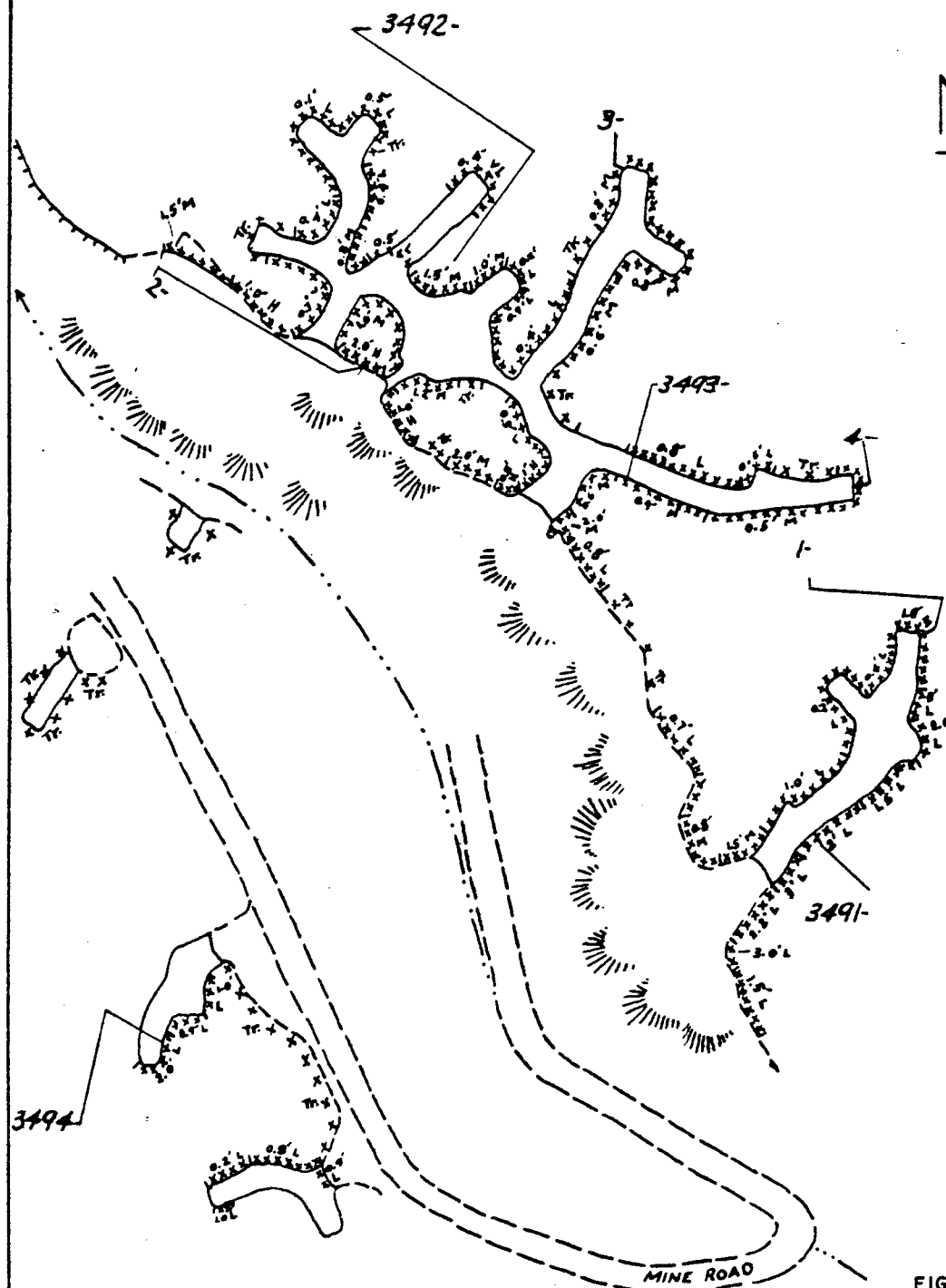
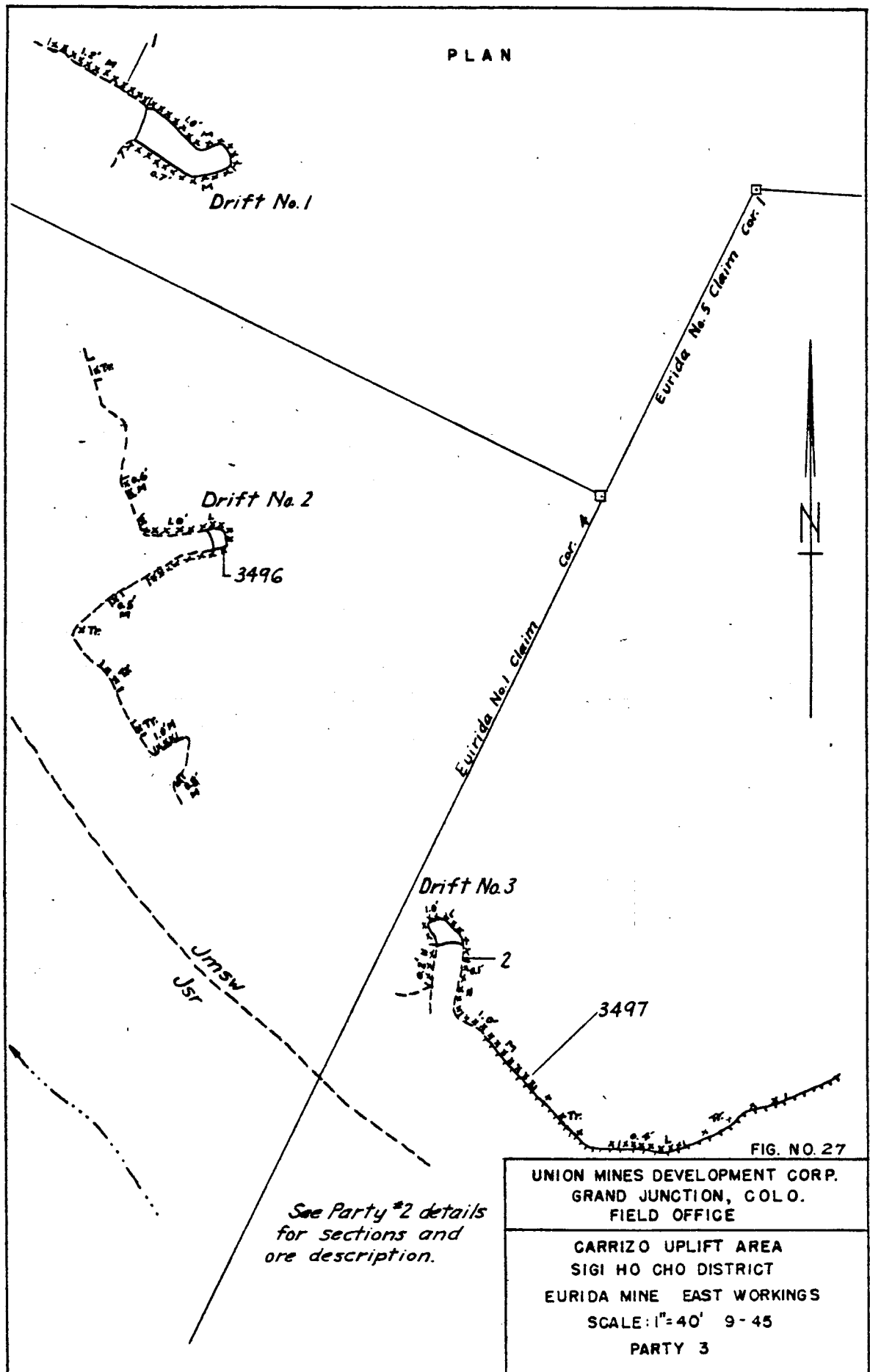


FIG. NO. 26

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
EURIDA MINE
SCALE: 1"=40' 11-29-43
REVISED BY PARTY 3, 9-45

PLAN



PLAN

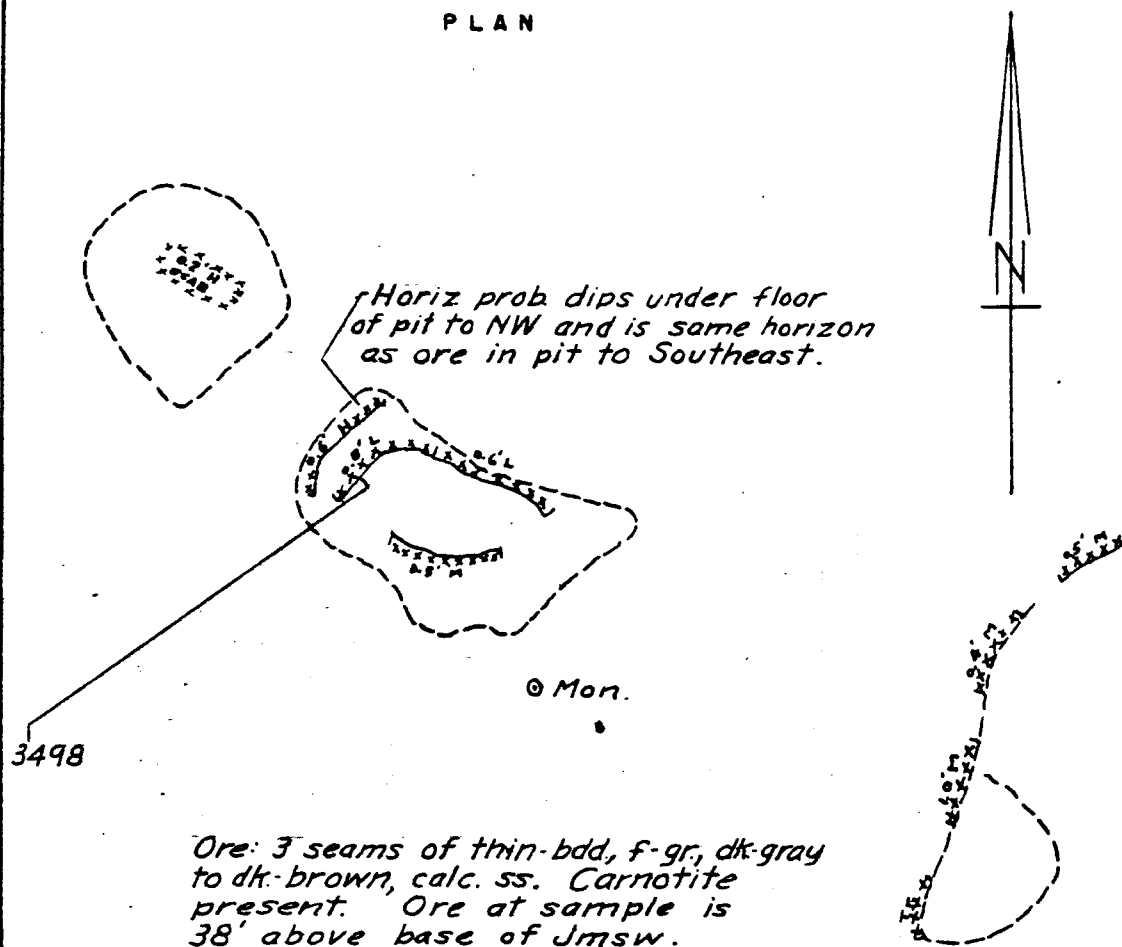


FIG. NO. 28

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
VCA PITS
E. END EURIDA MESA
SCALE: 1"=20' 8-28-45
PARTY 3

Ore: Lowgrade massive,
gray, med-gr, van. ss.

This mineralization
6' lower than upper
bed.

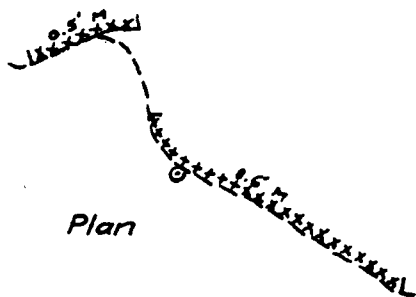
3502

JMON. Otc 35

Plan



OTC 37



Ore: Thin-bdd, carbonaceous,
shaly, van. ss. in lt-green shale
bed. Moderate amount of
carnotite. 17' above base of
Jmsw. Weakly-mineralized,
0.5' x 1' outcrop 200' west.

FIG. NO. 31

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

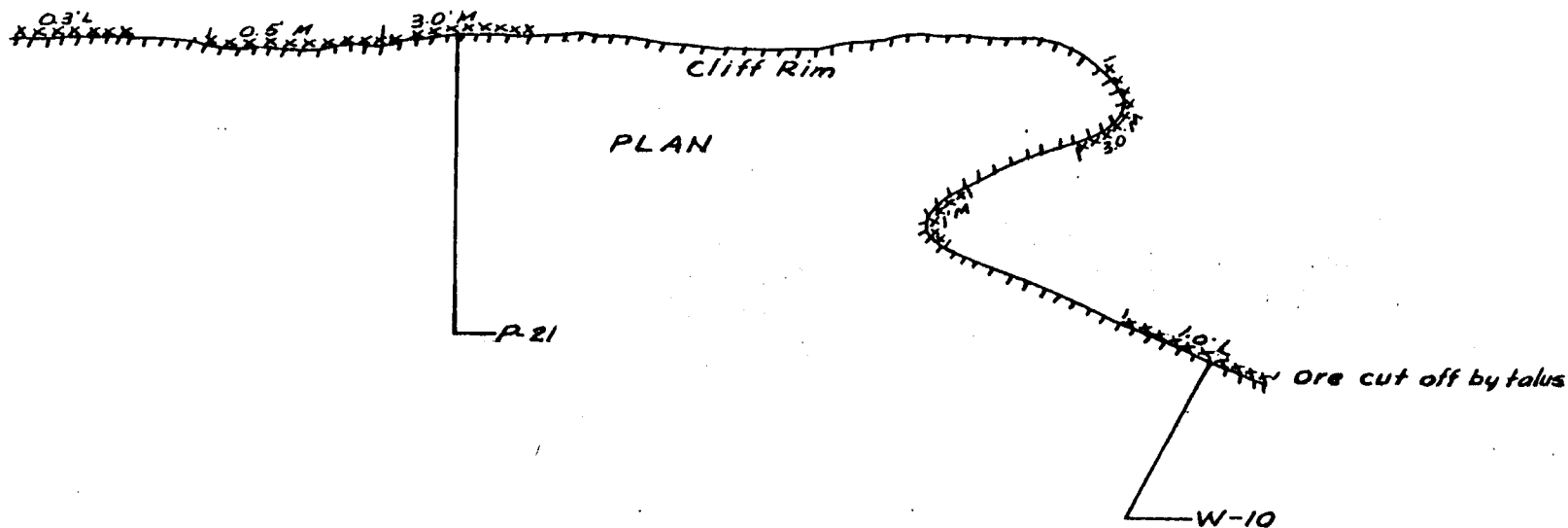
CARRIZO UPLIFT AREA

SIGI HO CHO DISTRICT

OUTCROPS 35 & 37

SCALE: 1" = 20' 9-45

PARTY 3



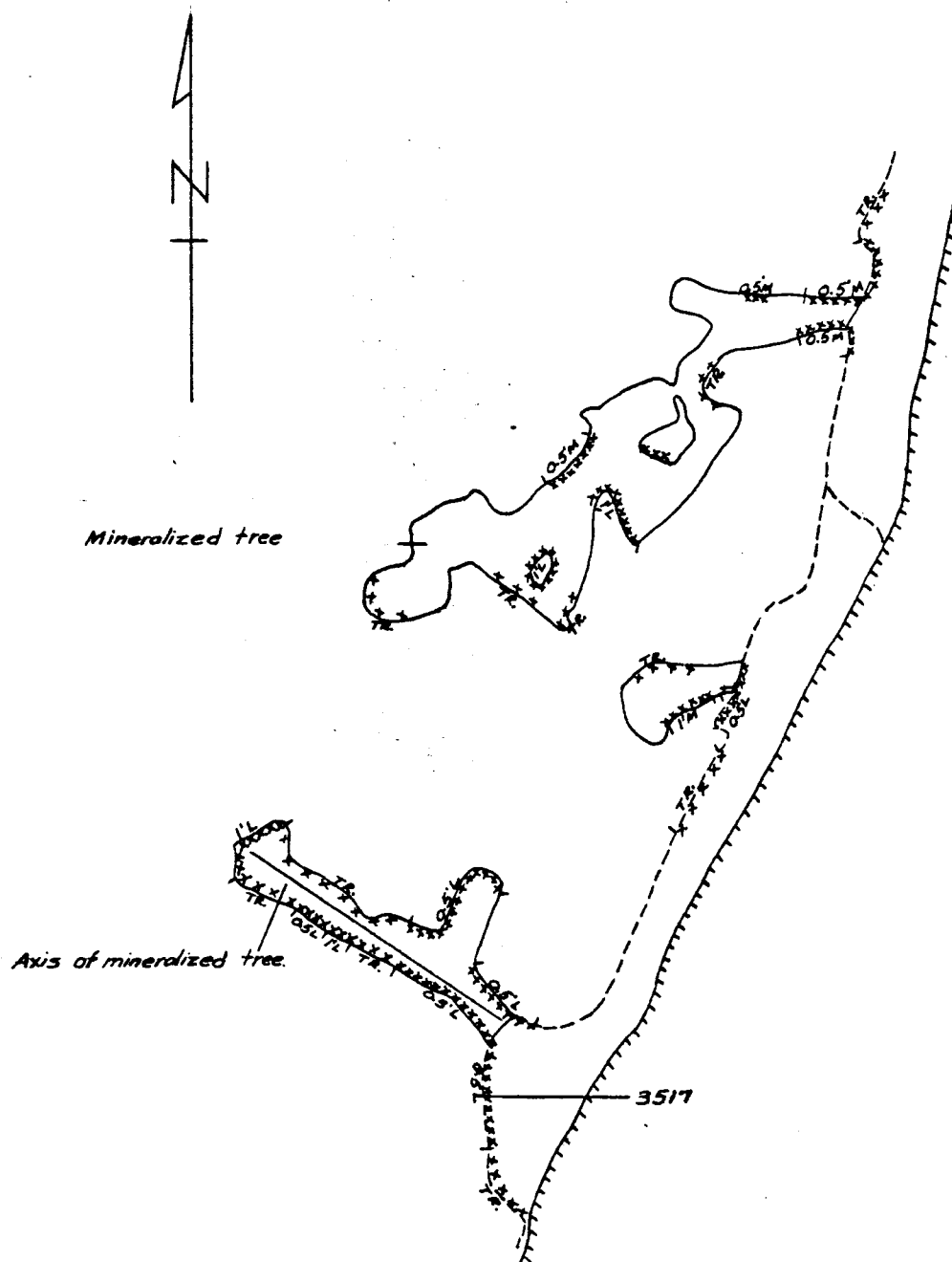
Outcrop S-3 Revised Oct. 1945

FIGURE NO. 34

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
SOUTH SAYTAH CANYON
OUTCROP S-3

SCALE: 1" = 20' OCTOBER, 1945
GEOLOGY & NOTES: PARTY NO 3



Ore is mostly halo mineralization of shaly Vanadiferous ss, and occurs in massive silty carbonaceous ss. near tree and vegetal pockets. Very little ore left in the mine.

FIG. 36

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
SAYTAH WASH
HOGAN MINE

SCALE: 1"=40'

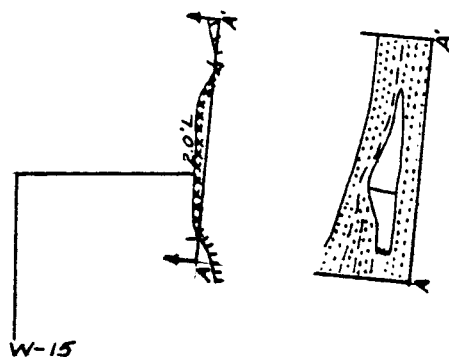
SEPT. 14, 1945

DRAWN BY: S.K.S. & L.B.

TRACED BY: J.W.H.

NOTES: S.K.S. & L.B.

OTC. M-3
SCALE: 1"=20'



Ore: Light gray, massive, Vanadiferous ss., with a few barren limestone patches. No visible cornotite, but secondary stain in sandstone below. Ore horizon is 29' above the Je.



OTC. NC-3
SCALE 1"=40'

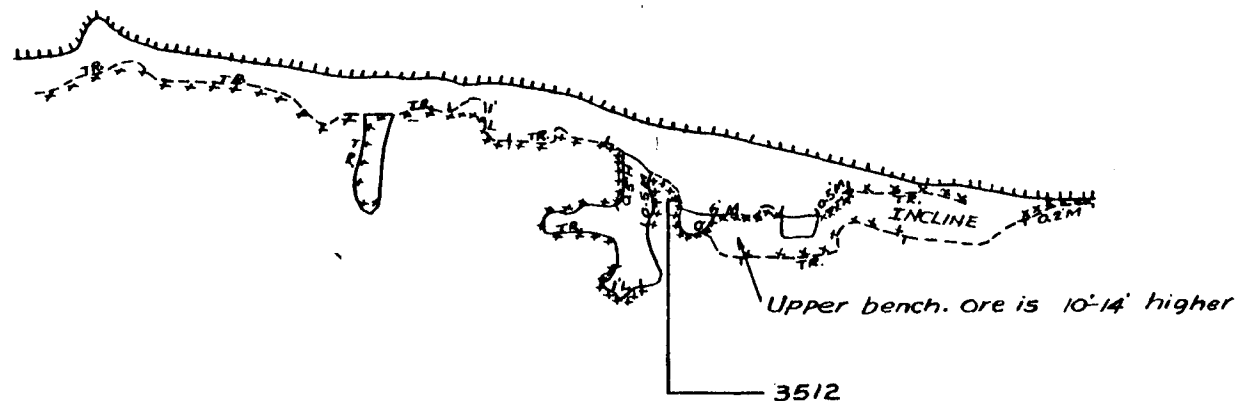


Ore: Massive, medium-gray, Vanadiferous ss., small amount of secondary stain and tree fragments. Ore horizon is 10' above the base of Jmsw.

FIG. 37

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
SAYTAH WASH
OUTCROPS M-3 & NC-3
SCALE: SHOWN ABOVE SEPT. 9, 1945
DRAWN BY: S.K.S.
TRACED BY: J.W.H.
NOTES: S.K.S.



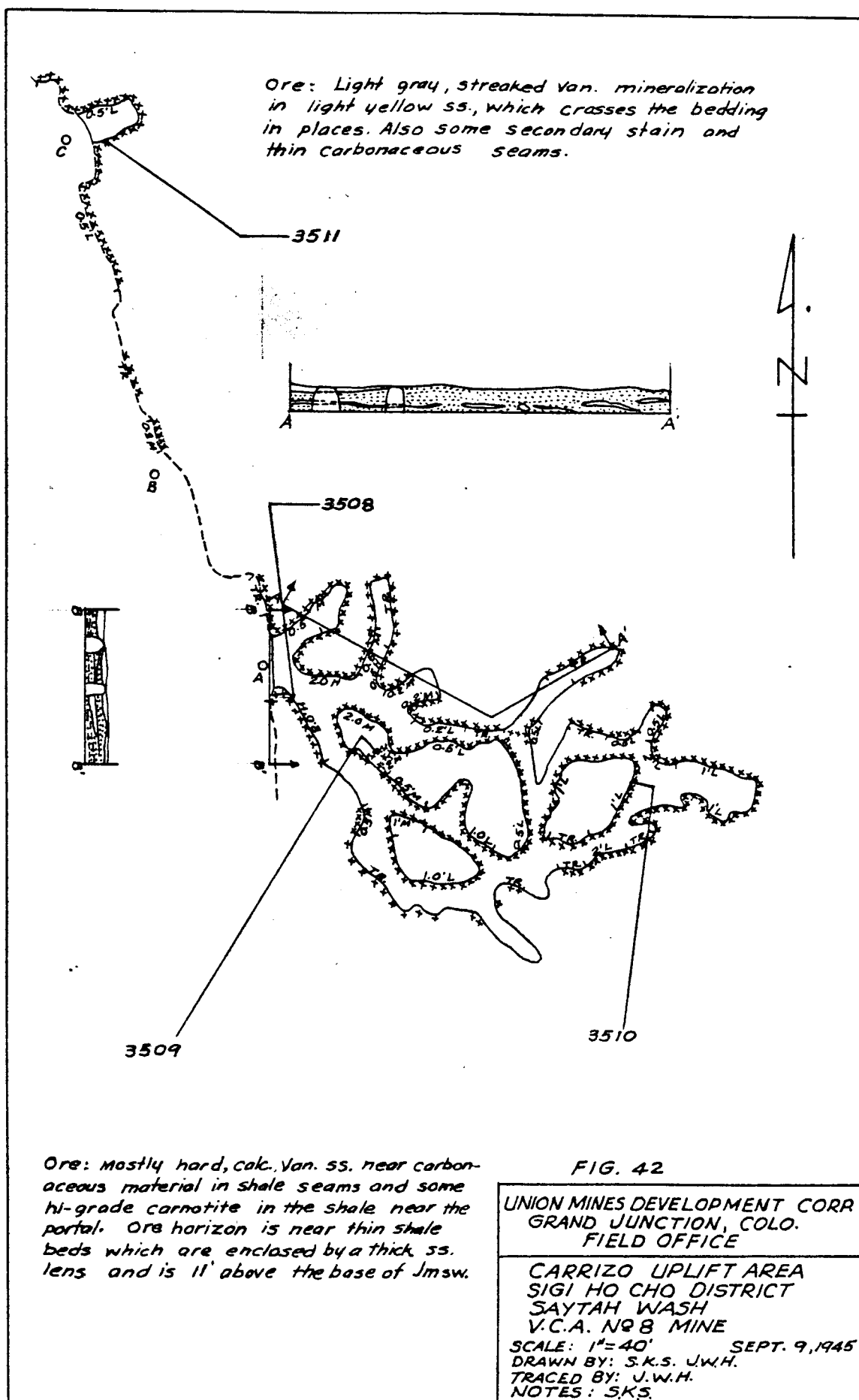
Ore occurs in a (25' thick) sandstone lens, along shale seams and occasionally in sandstone near vegetal pockets. The better ore, abundant with carnotite occurs in the shale seam. The weak ore occurs in carbonaceous mudstone. Lowest ore is 15' above the base of U_{msw}.

FIG. 38

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
SAYTAH WASH
NORTH MARTIN MINE

SCALE: 1"=40' SEPT. 10, 1945
DRAWN BY: SMYTH
TRACED BY J.W.H.
GEOLOGY & NOTES: SMYTH



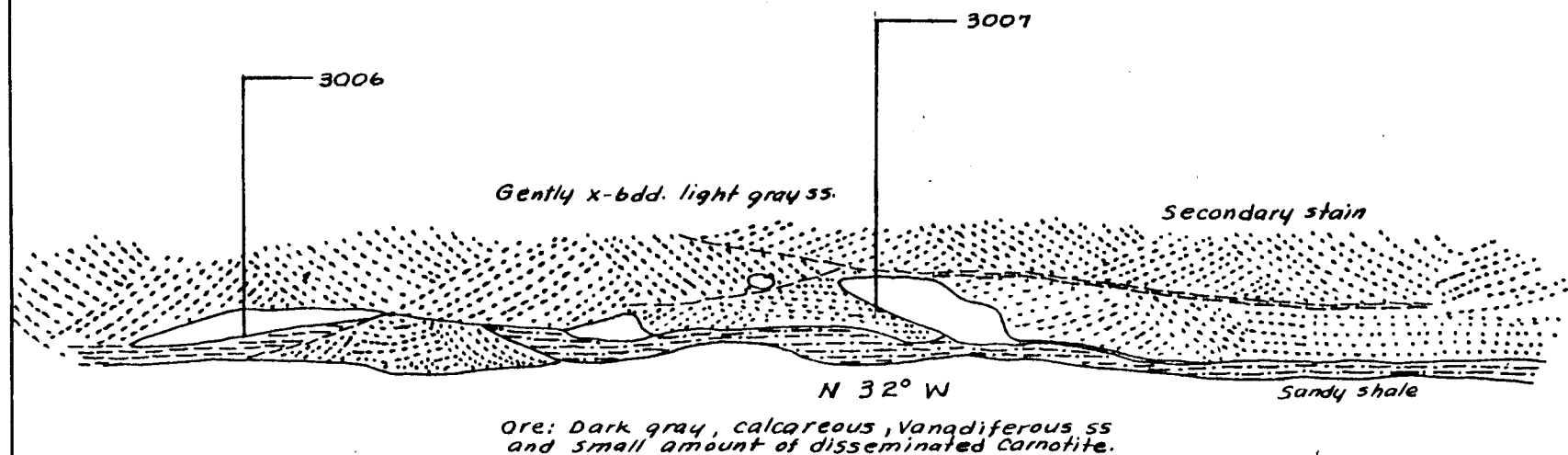
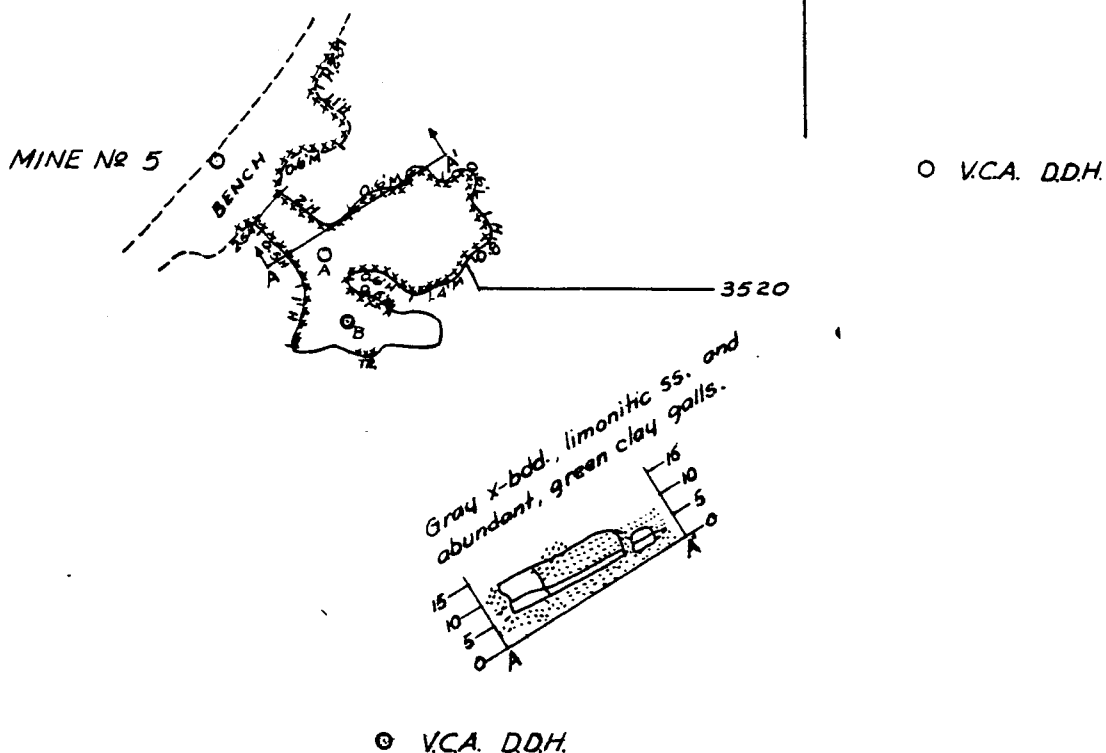


FIGURE NO. 43

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIFI HO CHO DISTRICT
SAYTAH WASH
OUTCROP NC-2

SCALE: 1" = 10' APRIL, 1944
GEOLOGY & NOTES: PARTY NO 3



Ore occurs as halo mineralization of a concentrated tree and vegetal pocket, and is 42' above the base of Jmsw.

N.B. 547W, 70' from Mine No 5 there is an outcrop 12' long and 1.5' thick of Vanadiferous ss. and abundant carnotite, cut off at both ends by a shale seam. Otc. is 30' above the Ue Form. Sample No 3516

FIG. 44

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
RATTLESNAKE GROUP
MINE NO 5

SCALE: 1"=40' SEPT. 9, 1945
DRAWN BY: HARSHBARGER & WALLS
TRACED BY: HARSHBARGER
GEOLOGY & NOTES BY: WALLS

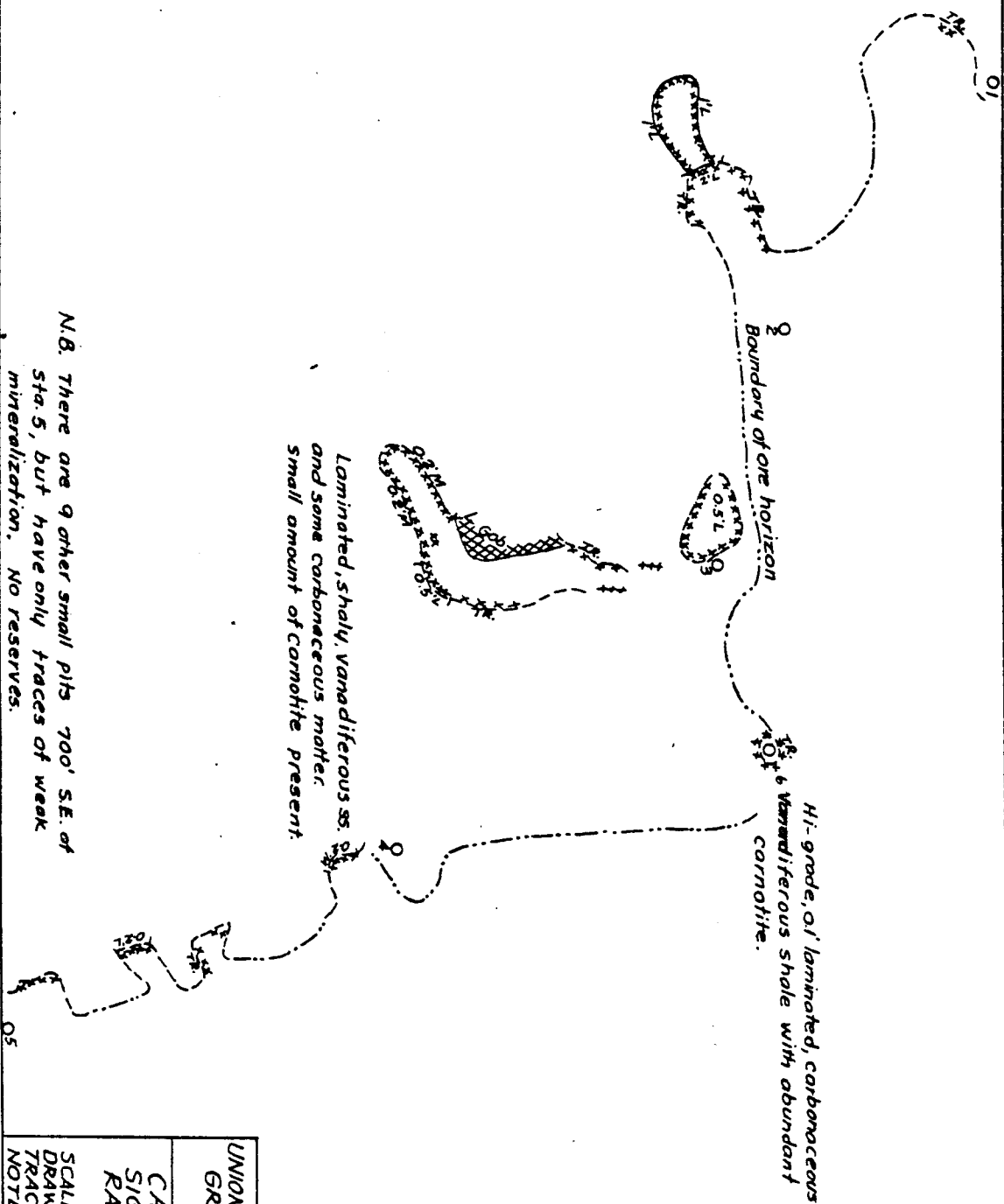


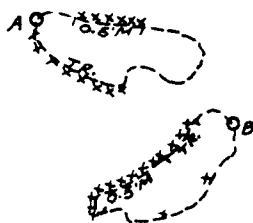
FIG. 45

UNION MINES DEVELOPMENT CORP. GRAND JUNCTION, COLO. FIELD OFFICE	CARRIZO UPLIFT AREA SIGI HO CHO DISTRICT RATTLESNAKE GROUP EAST PITS
--	---

SCALE: 1"=40'
 DRAWN BY: S.K.S.
 TRACED BY: J.W.H.
 NOTES: S.K.S.

SEPT. 11, 1945

PIT RC-1



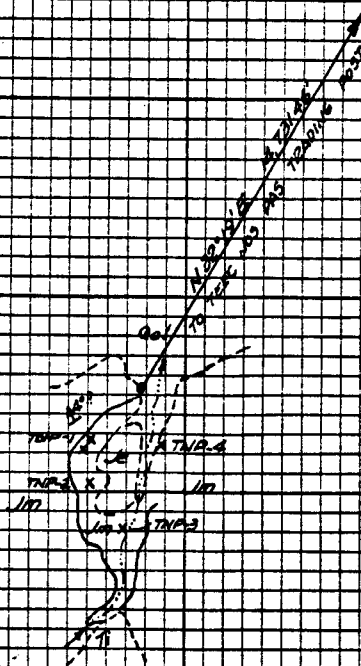
N.B. N65°W, 50' of sta "A" there is a 8' adit, near 1'-2' Van. mineralization of shaly carbonaceous ss. Adit cuts behind ore II to the etc., exposing an ore limit of 5' long, 3' deep and 1' thick. Ore horizon is 27' above the base of Jmsw.

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
RATTLESNAKE GROUP
MINE RC-5 & PIT RC-1

SCALE: 1"=40' SEPT. 14, 1945
DRAWN BY: S.K.S., J.W.H.
TRACED BY: J.W.H.
NOTES: S.K.S.

Upper Morrison
sediments west to
CARRIZO AREA



SKETCH MAP
as

VIA DE A LEASE

TEEC Nos PAS Ariz

Scale 1" = 2000' Forward
April 1, 1944 Portage

LEGEND

Ti	IGNEOUS INTRUSIVES
Jm	MORRISON SS
Jc	ENTERON SS
/	CANYON ERM
-	GEOL. CONTACT
TNP-2	VANADIUM SHOWING

FIGURE NO. 48

UNION MINES DEVELOPMENT CORP
GRAND JUNCTION, COLO.
FIELD OFFICE
CARRIZO UPLIFT AREA
TEEC NOS PAS LOCALITY

SCALE: 1" = 2000' APRIL, 1944
GEOLOGY & NOTES: PARTY NO. 3

PLAN



3500

MON.

3499

0'-mark on Party 2 section.

11' lower than B.

FIG. NO. 29

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
PORTIONS OF MINERALIZED OTGS
EURIDA NO. 2 CLAIM
SCALE: 1"=40' 9-45
PARTY 3

OA

on Party 2

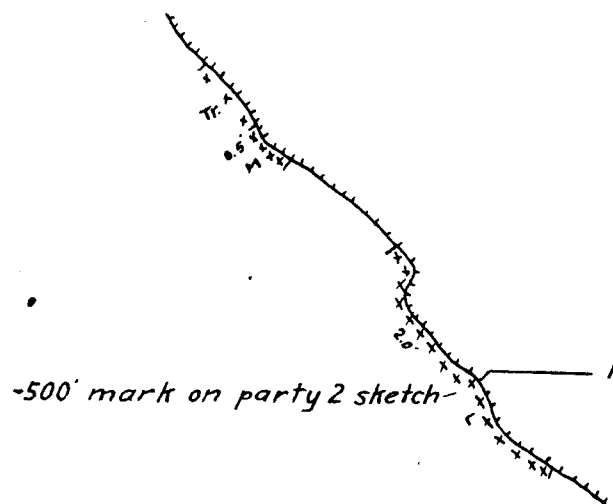
B

0.5' Tr.

0.2'

0.5' L

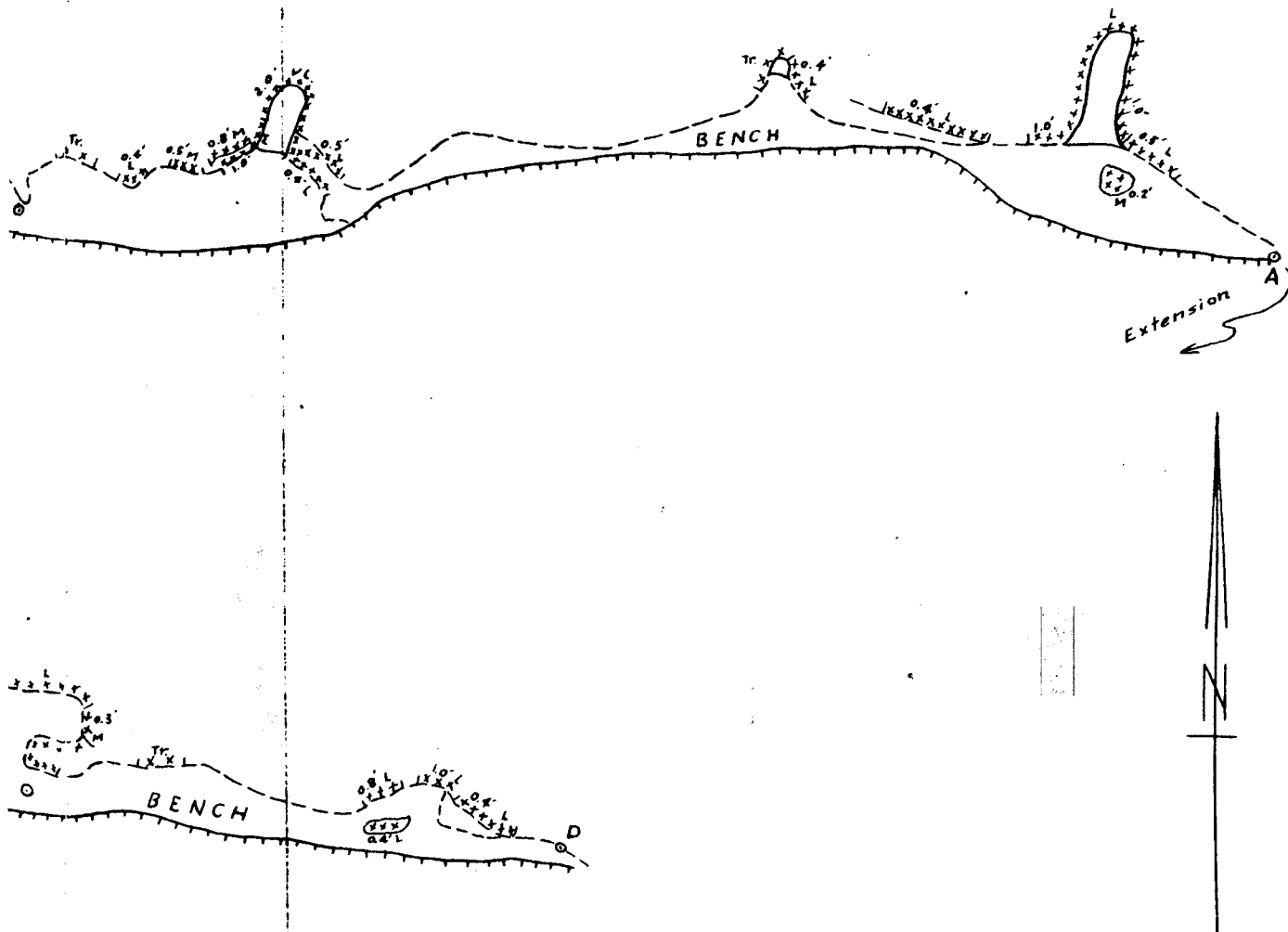
P L A N



See Party 2 details for sections
and ore descriptions.

Pt. B is :
section:

PLAN



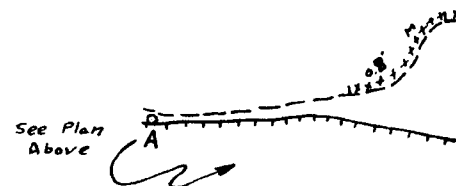
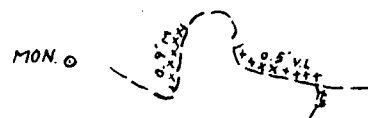
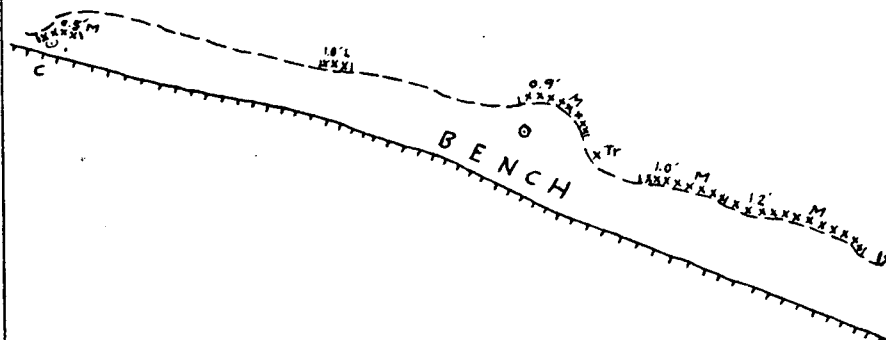
*See Party 2 details
for sections and ore
descriptions.*

FIG. NO. 30

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
EURIDA CLAIM — VCA
SCALE: 1"=40' 9-45

PARTY 3



NORTH SAYTAH CANYON

Jmsw

Jm

#10

Jmsw

PLOT 4

SEE FIG No

CBW-18

CBW-17

OCBW-16 10.4 ACRES

S-1 CBW

SOUTH SAYTAH CANYON
Qal

Jmsw

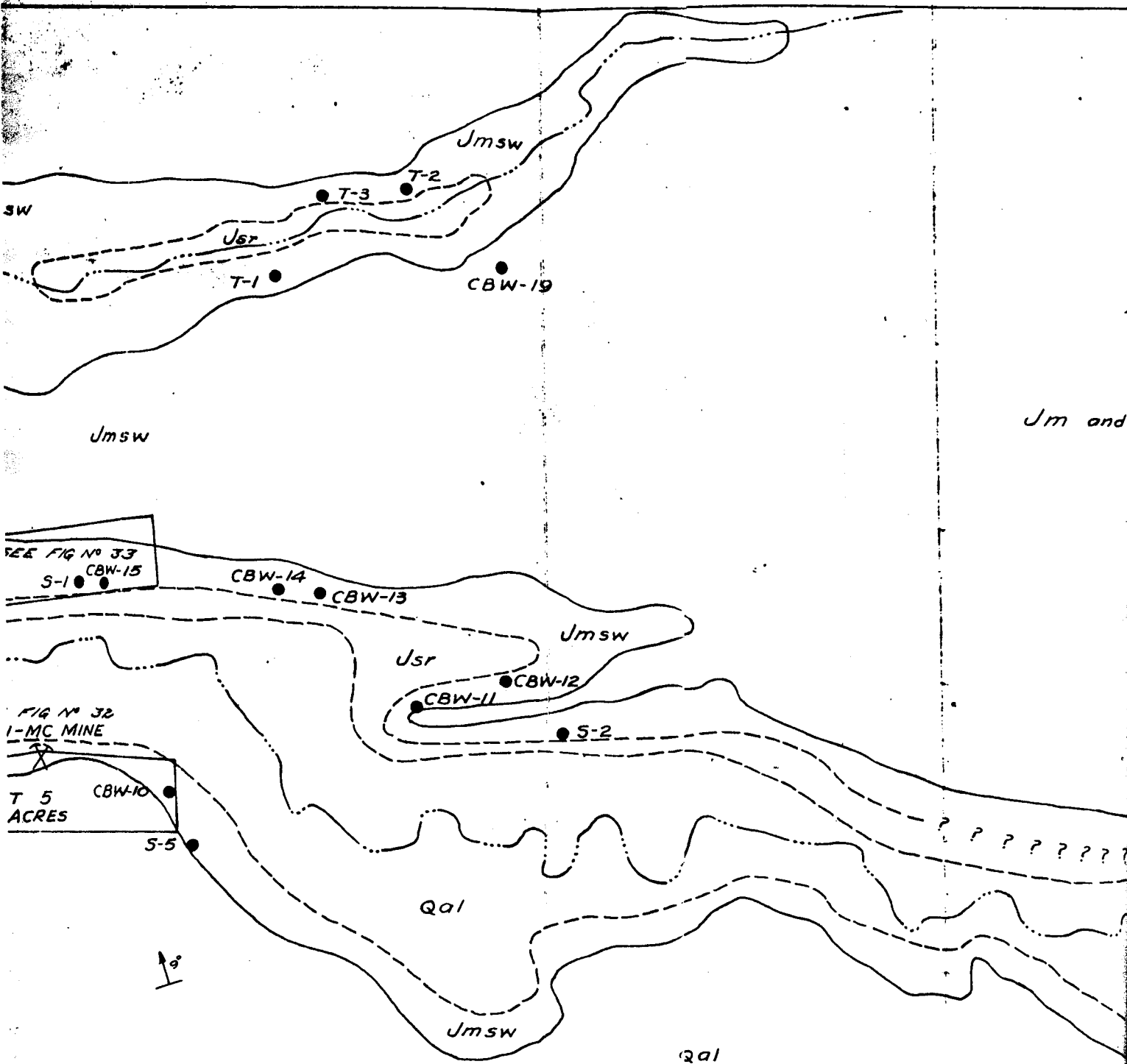
SEE FIG No 32

CBW-MC MINE





PLOT 5 CB
5.7 ACRES

Jmsw

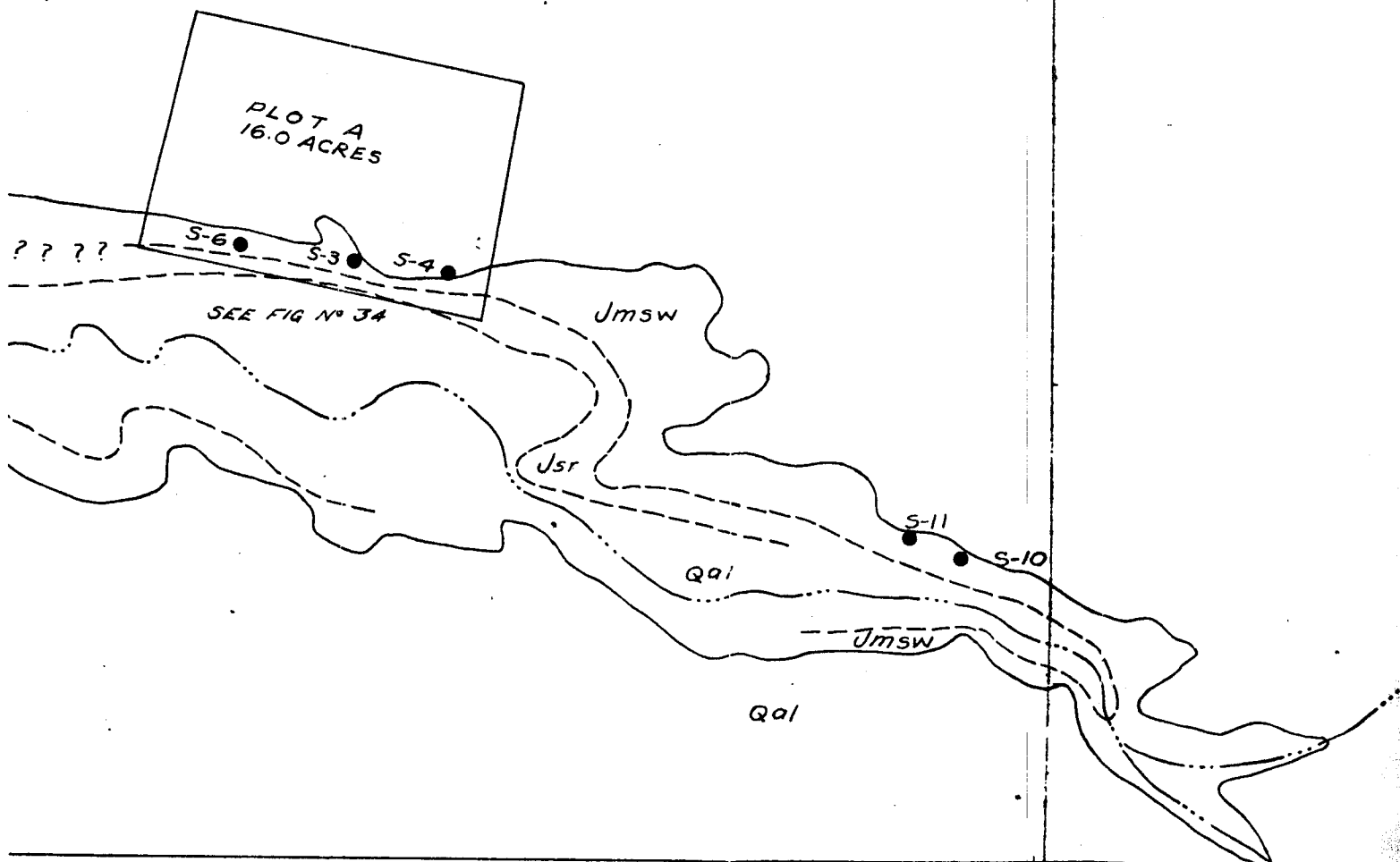
Qal



LEGEND

- Qal ALLUVIUM
- Jmsw MORRISON FORMATION
- Jsr SAN RAFAEL GROUP
- PLOT 4 U.M.D.C. LEASE
-  MESA RIM
-  GEOLOGIC CONT.
-  ORE OUTCROP
-  INTERMITTENT C

and Qal



LEGEND

ALLUVIUM

MORRISON FORMATION (Salt Wash Member)

SAN RAFAEL GROUP

U.M.D.C. LEASE BOUNDARY

MESA RIM

GEOLOGIC CONTACT

ORE OUTCROP

INTERMITTENT DRAINAGE

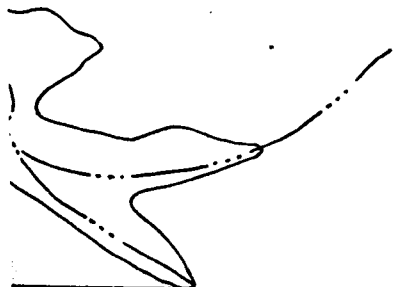


FIGURE NO. 35

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
SKETCH OF SAYTAH CANYON
SHOWING ORE BLOCKS

SCALE: 1" = 500' NOVEMBER, 1945
GEOLOGY & NOTES: PARTY NO 3



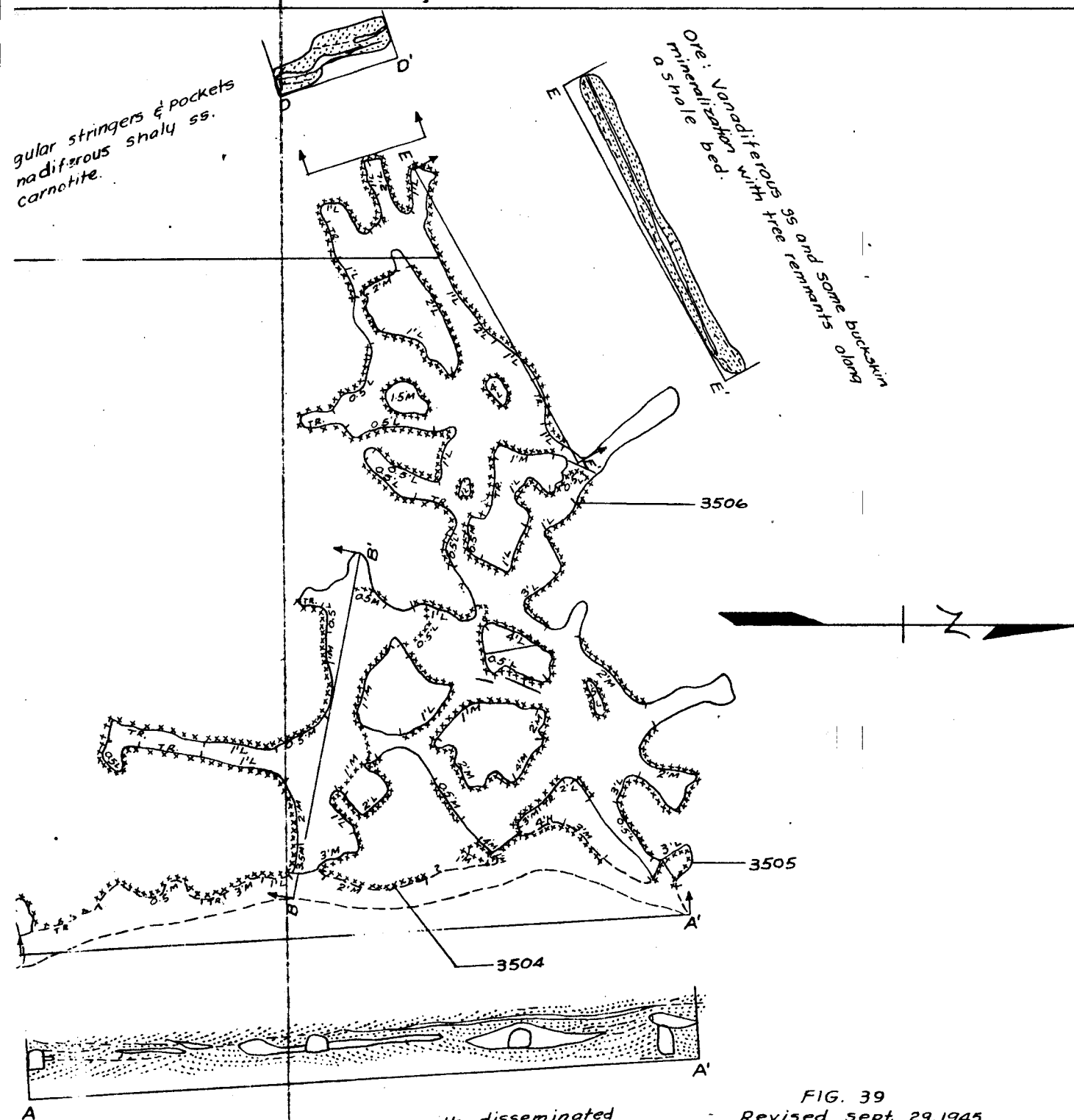


FIG. 39
Revised Sept. 29, 1945

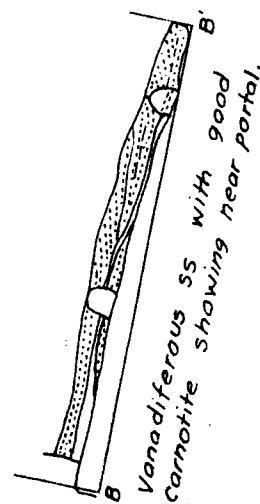
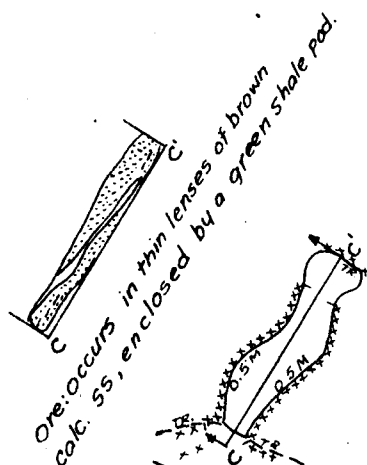
UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
SAYTAH WASH
MARTIN MINE

SCALE: 1"=40' APRIL 14, 1944
DRAWN BY: S.K.S. J.W.H.
TRACED BY: J.W.H.
NOTES: S.K.S. J.W.H.

Irr
of
N

3507

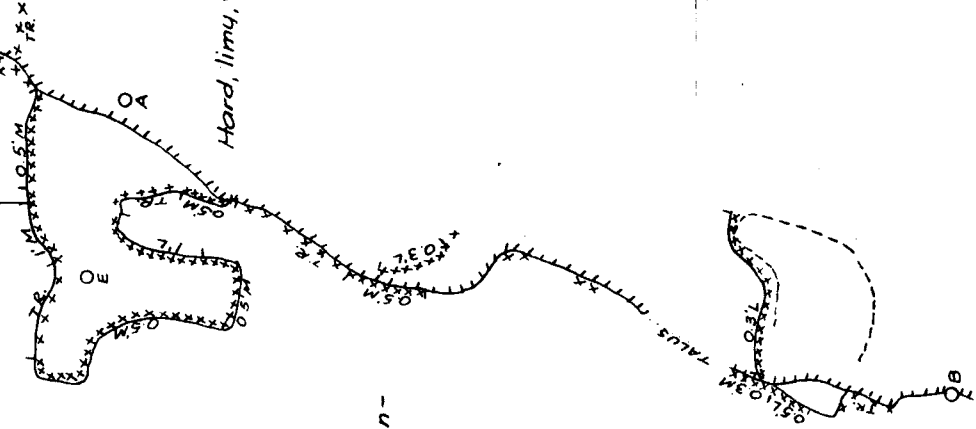


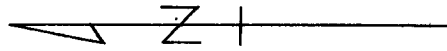
N.B. 90' south of section c-c, there is a 10' adit on a 30' otc., the ore pinches out 5' from the portal. The otc. occurs in a x-bdd. ss and is cut off by shale beds to the west. The otc. has a maximum thickness 0.5' of low grade mineralization.

Mineralized tree

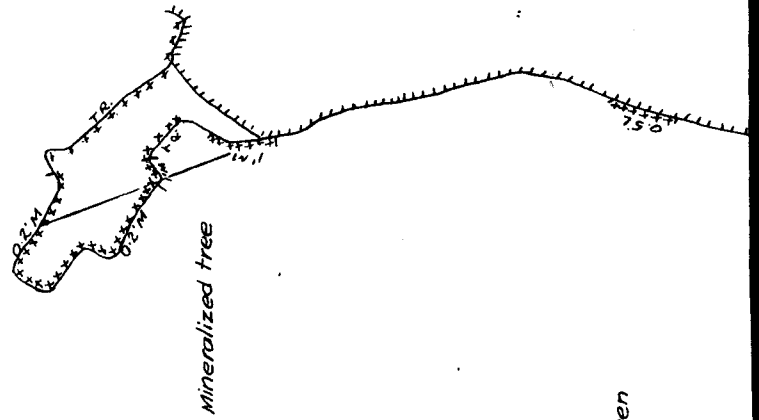
Ore occurs as pockets in sandstone, in or near shale lens, between limbs of large scours, and is 8-11' above the Ue Form.

3503





00



*Halo mineralization of weak Vanadiferous ss.,
along shale seam. some Carnotite near tree.*

*Hard limy Vanadiferous ss., along green
shale seam.*

us, Shuly

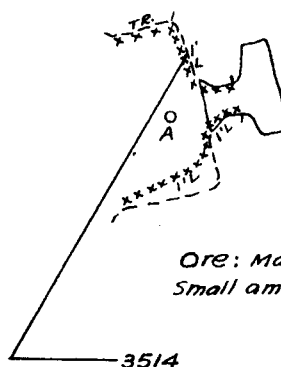


PIT N^o 2



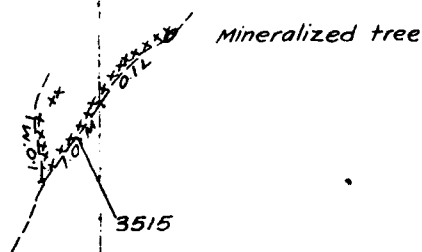
There are two pits (10'x10'), 300' N of sta. B, with poorly exposed mineralization of laminated, carbonaceous vanadiferous ss.
At 140' N of sta. B there is a small pit (3'x2') with a trace of mineralization.

PIT N^o 1



Ore: Massive gray vanadiferous ss. and small amount of tree & carbonaceous material

PIT N^o 5



Ore: Hard calcareous vanadiferous ss., along a shale seam containing tree fragments and other carbonaceous material.

FIG. 41

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

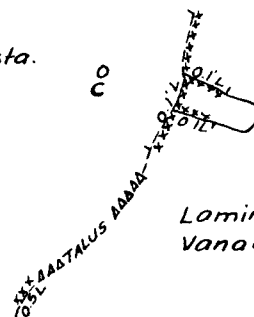
CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
SAYTAH WASH
PITS, VICINITY LEASE N^o 3

SCALE: 1" = 40' SEPT. 12, 1945
DRAWN BY: S.K.S.
TRACED BY: J.W.H.
NOTES: S.K.S.

PIT N^o 3

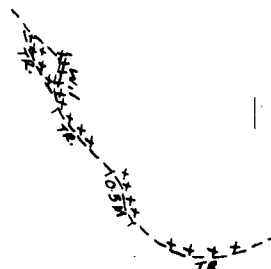
Sta. "C" is 600' North of Sta.
"A", Pit N^o 1

O
C



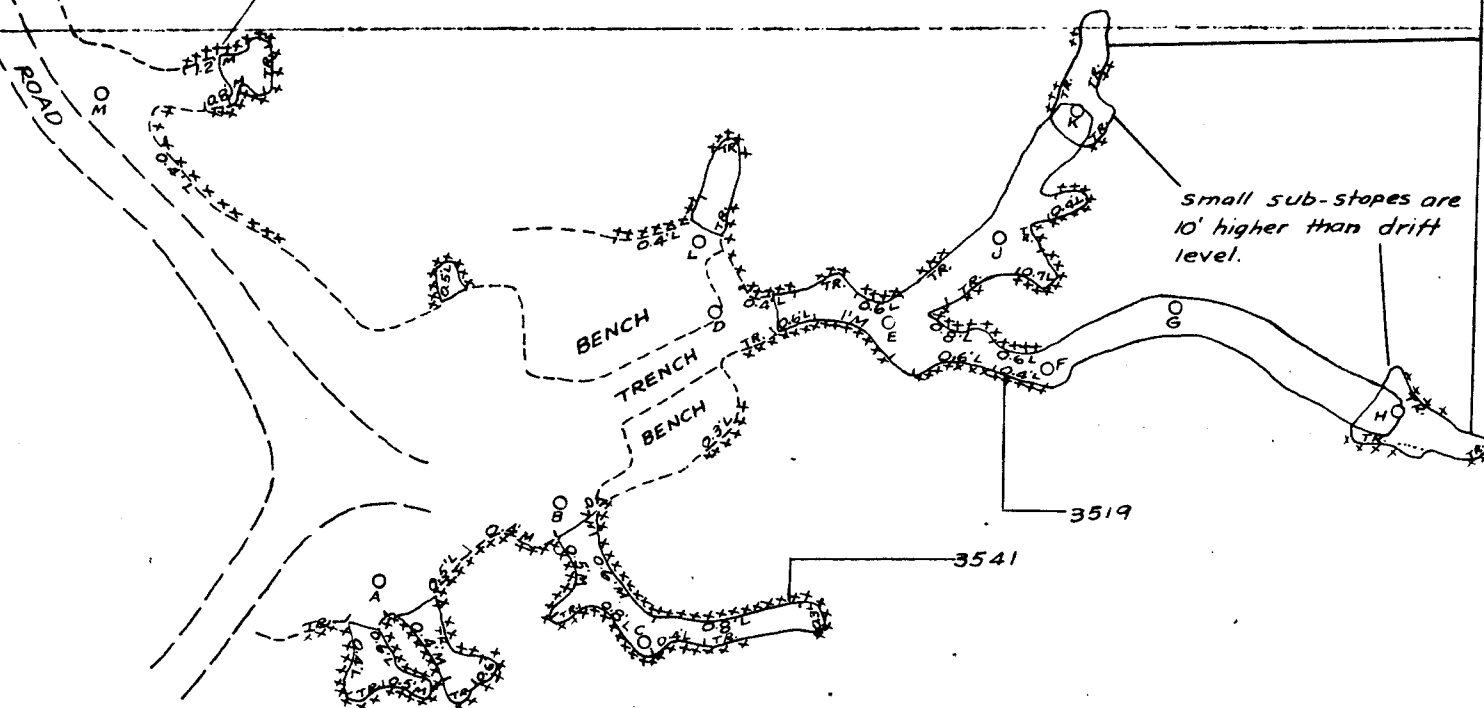
Laminated, carbonaceous
Vanadiferous ss.

PIT N^o 4



Ore: shaly vanadiferous ss in a carbonaceous
trash pocket.

Traces of weak mineralization of laminated carbonaceous shaly ss, in the back of the stapes.



ore: Thin-bdd., x-bdd., gray calc. van. ss, with occasional patches of disseminated carnotite. In the two small S.W. drifts the ore occurs as halo mineralization in undulating lenses of shaly carbonaceous ss. with some secondary carnotite. Ore is 23' above Je.

FIG. 47

UNION MINES DEVELOPMENT CORP.
GRAND JUNCTION, COLO.
FIELD OFFICE

CARRIZO UPLIFT AREA
SIGI HO CHO DISTRICT
RATTLESNAKE GROUP
MINE RC - 7

SCALE: 1"=40' SEPT. 14, 1945
DRAWN BY: J.W.H. & R.B.W.
TRACED BY: J.W.H.
NOTES: J.W.H.

